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FOR THE
STUDY OF ORTHODONTICS

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1952

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13

Double Prognathism in Daily Practice

HAROLD CHAPMAN, F.D.S.R.C.S.

IT WOULD be ungracious of me not to thank you again, and to express my gratification for the honour you have done me in electing me to preside over our affairs for a second session. I am not unmindful of the sacrifice made by those who have stood aside, Mr. Pilbeam in the first place, to make this possible; to them I extend additional thanks.

The previous occasion on which I occupied this chair was in 1925; in the intervening twenty-seven years the membership has doubled.

The other member who has occupied the chair twice (I omit the period of the two wars) is the late George Northcroft who founded the Society in 1907, and from that time until his untimely passing in 1944 I was closely associated with him; to follow such an outstanding personality is indeed a special privilege.

It was March 1951 when the Council invited me to the Chair for a second term; at the same time the February, 1951 A.J.O. came to hand with an article by Professor Arne Bjork, (1951a) now of Copenhagen, in which appeared the statement: " Alveolar prognathism diminishes during growth, the incisors become more upright " in male Swedes twelve to twenty years of age. This was an arresting statement and gave the text for this address: after the address was written *The Dental Record*, November, 1951, appeared with another article by Bjork (1951c) including a statement apparently contradicting the former: " The cross-sectional i.e. average difference in Swedes at twelve and twenty-one to twenty-two years of age shows an appreciable change with increased prognathism of both jaws and the incisors become more upright." Bjork continues " Individual cases deviate very considerably from these average growth changes of the face which are characterized by an increase in the prognathism. The question is whether this relationship differs in the individual."

Bjork records analyses of six cases; all cover the period twelve to twenty years. Case 71 shows an increase of double prognathism; in Case 110 the prognathism is unchanged, and in Case 62 it is reduced in both jaws: the other three cases show different changes in the two jaws. Only one case of the six shows reduction of double prognathism.

The explanation may lie in Bjork's remarks: " The results of such an analysis will be affected by the simplified diagrammatic representation employed." The diagrams were drawn from lateral X-rays.

It is disappointing not to be able to assure parents that double prognathism will diminish with age, therefore it becomes more important to consider individual

Presidential Address presented to the meeting on 14th January.

cases and what treatment, if any, to adopt. This emphasises again, the value of serial records of actual cases, untreated as well as treated—models and photographs would suffice: this could have been done before the cephalometric era, but we must be grateful to Bjork for pointing out that observations obtained statistically and clinically may be at variance.

The subject is one of topical interest; in addition to Bjork's papers, there have been other recent references to it; Mr. Rix asked Professor Friel (1951) at the November, 1951, meeting of the British

Figs. 1 *and* 2 *illustrated the paper by the author in* 1925 (*see bibliography*); *grateful acknowledgment is made for their use here.*

Society for the Study of Orthodontics if he could confirm Bjork when he said: "During growth alveolar prognathism diminishes."

In the Bulletin of the Pacific Coast Society of Orthodontists, September, 1951, appears the following: "It was brought to the attention of the membership that there is a growing demand in this area by negroes for orthodontic treatment. Very few orthodontists have indicated that they care to accept them as patients. It was moved that a committee call on Dr. McNulty, Dean of the School of Dentistry,

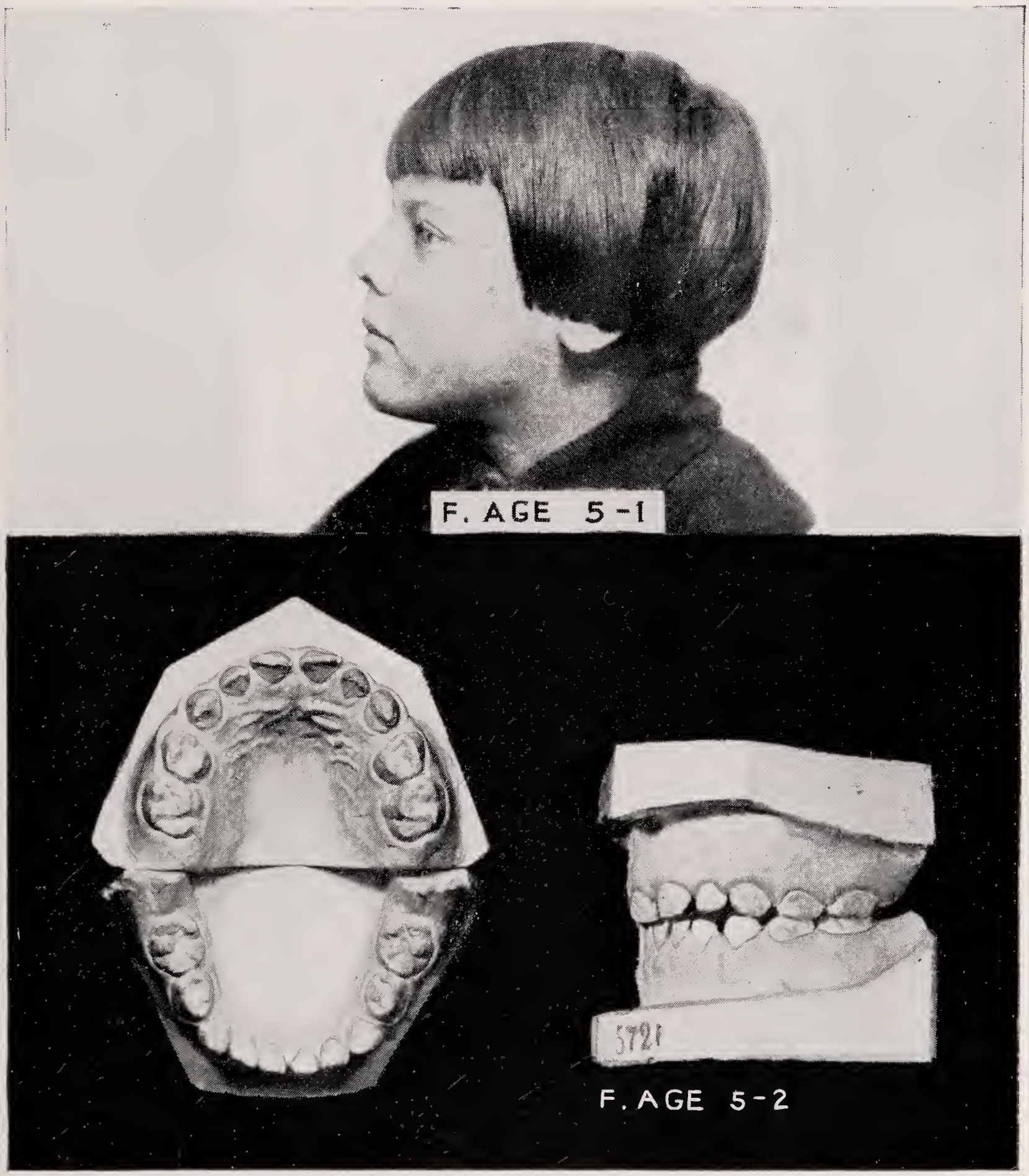

FIGURE 2. (Part 1)

FIGURE 2. (Part 2)

University of Southern California, and request that they accept a negro dentist for training in the orthodontic department of the Graduate School. Motion carried." Inferences only can be drawn as to the treatment demanded, but one may perhaps "suspect," a word so popular with Sir Arthur Keith, that it includes reduction of double prognathism.

Bjork (1951a) says: "During the growth period subsequent to the first years of life, the prognathism of the entire face increases due to continued growth of the jaws." I recall that children (Fig. 1) with normal occlusion at about six years of age have a prognathic appearance and that in one such case (Fig. 2) there is a mild degree of post-normal occlusion on the left side, but at age thirty-two to thirty-four there is no outward appearance of either prognathism or post-normality. In this connection I mention a friend, an adult, whom I did not know professionally, who appeared to have an excellent normal occlusion without spacing but who had a distinct prognathic appearance. Obviously, treatment could be of no avail, or would have been had it been sought in childhood; one wondered if there were some race admixture to account for the condition.

I record seven cases of double prognathism which I have seen professionally

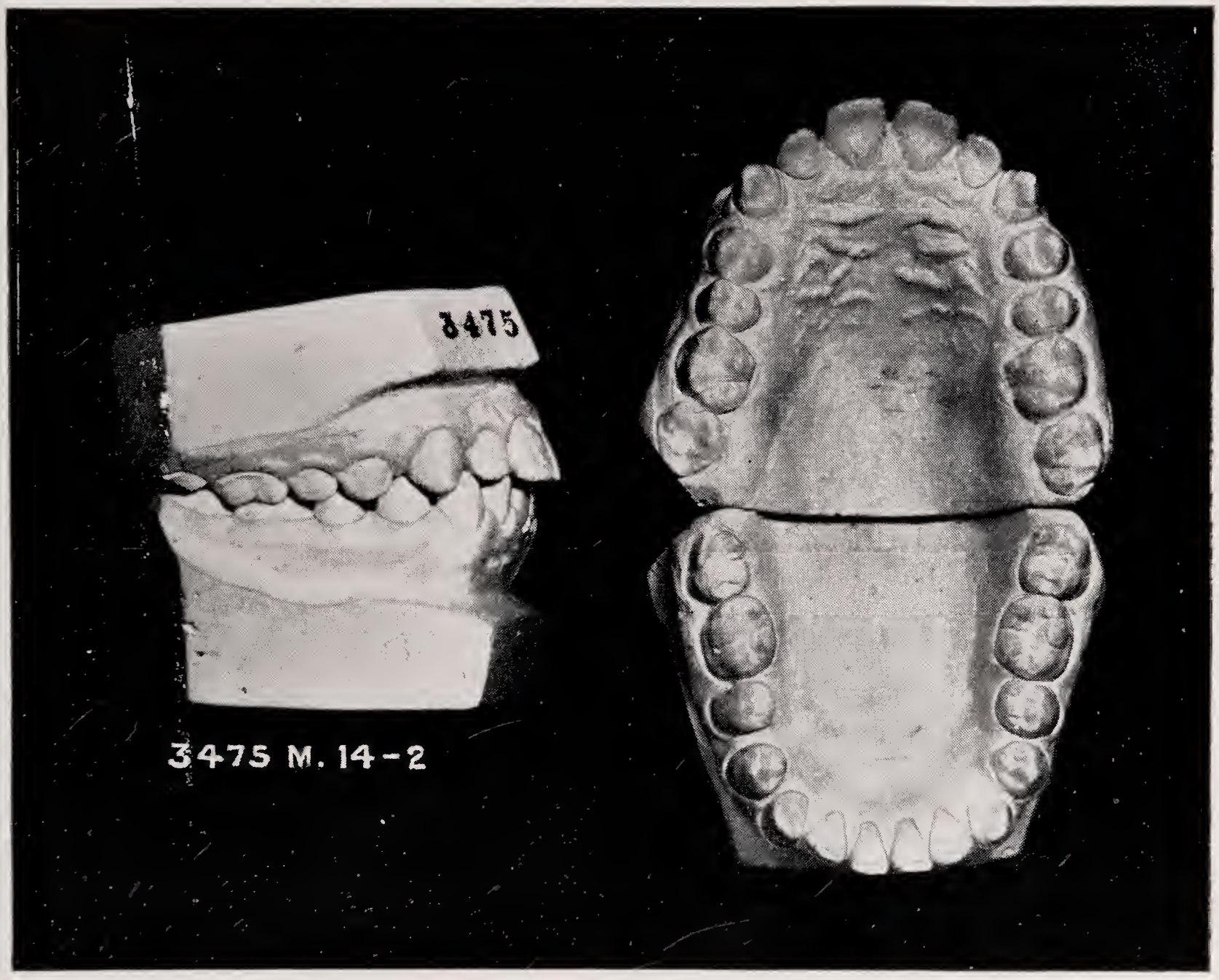

FIGURE 3.

Case No 3475 M. Age 41-2

Normal occlusion: 63/ /36 in normal relation to 63/ /36. Well-developed jaws: spacing of upper incisors and less spacing of lower incisors. An excellent occlusion. 1/1 in proclination. Lower incisors also in proclination in contact with upper incisors: perhaps slight excess overbite. This appears to be a case of double prognathism. Treatment contra-indicated. Exerciser given to train patient to keep lips closed. Elocution lessons recommended. Parents wished for treatment.

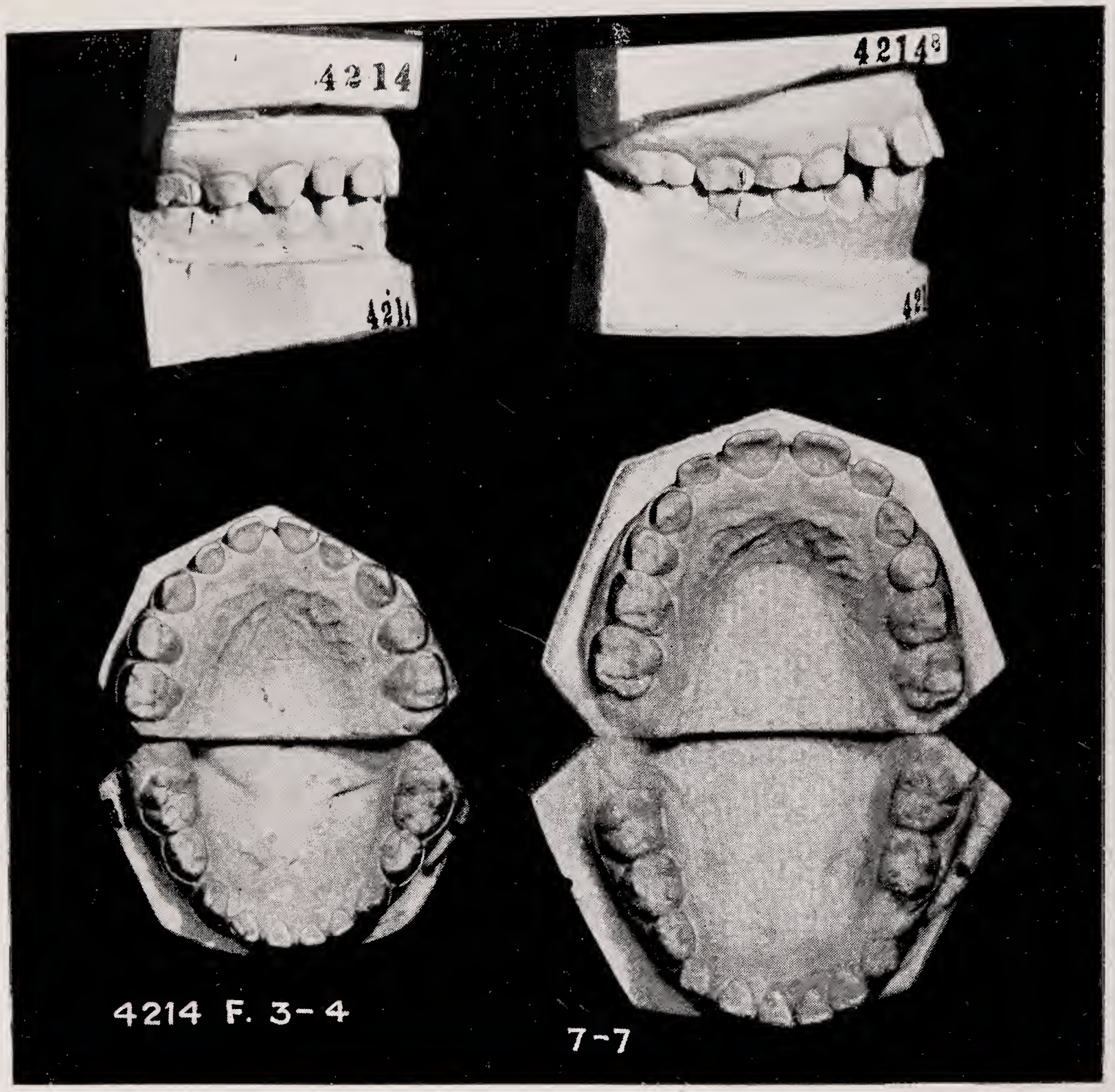

FIGURE 4.

Case No. 4214 F. Age 3-4.

1. Dentition: edcba/abcde
   edcba/abcde
5. Arches: excellent. Good spacing of all teeth except ed/de (slight of ed/de). Slight attrition.
6. Overbite: 3 mm. Overjet: 3 mm.
8. Incisor (a) alignment: excellent.
   (b) relation: good; a/a on cingula a/a suggestive of excessive overbite.
11. Diagnosis: arch relation normal for age. Tips of c/c not between cb/bc. ? normal occlusion.
12. Fillings: Nil. Caries: Nil.
14. General condition of mouth: clean and healthy.
17. (c) Width a/: 6.1 mm. Average (Black) 6.5 mm.
    Width a/: 4.0 mm. Average (Black) 4.2 mm.

Age 7-7:

1. Dentition: 6edc21/12cde6
   6edc21/12ce6
2. Premature loss decid. teeth: /d lost naturally age 7-6.
5. Arches: excellent.
6. Overbite: 2.5 mm. Overjet: 2.5 mm.
8. Incisor alignment and occlusion excellent but all, upper and lower, in proclination, i.e. bimaxillary prognathism. Spacing of upper incisors and c2/2c
   c2/2c
10. Reduced spaces: loss of /d space 0.5 mm. Parents wished for treatment.
11. Diagnosis: Normal arch relation. N.B.—change in relation of c/c from age 3-4.
    c/c
    ? normal occlusion. Lower centre 1.5 mm to left.
12. Fillings: d/de
    ed/ e
17. (c) Width 1/: 8.7 mm. Average (Black) 9.0 mm.
    Width 2/: 6.5 mm. Average (Black) 6.4 mm.
25. Advised: not to treat—prognosis uncertain Face will tend to grow to teeth, so prognathism likely to become less, also Bjork suggests that the angle between upper and lower incisors will be reduced after 12 years of age. Parents, especially the mother, anxious for treatment.

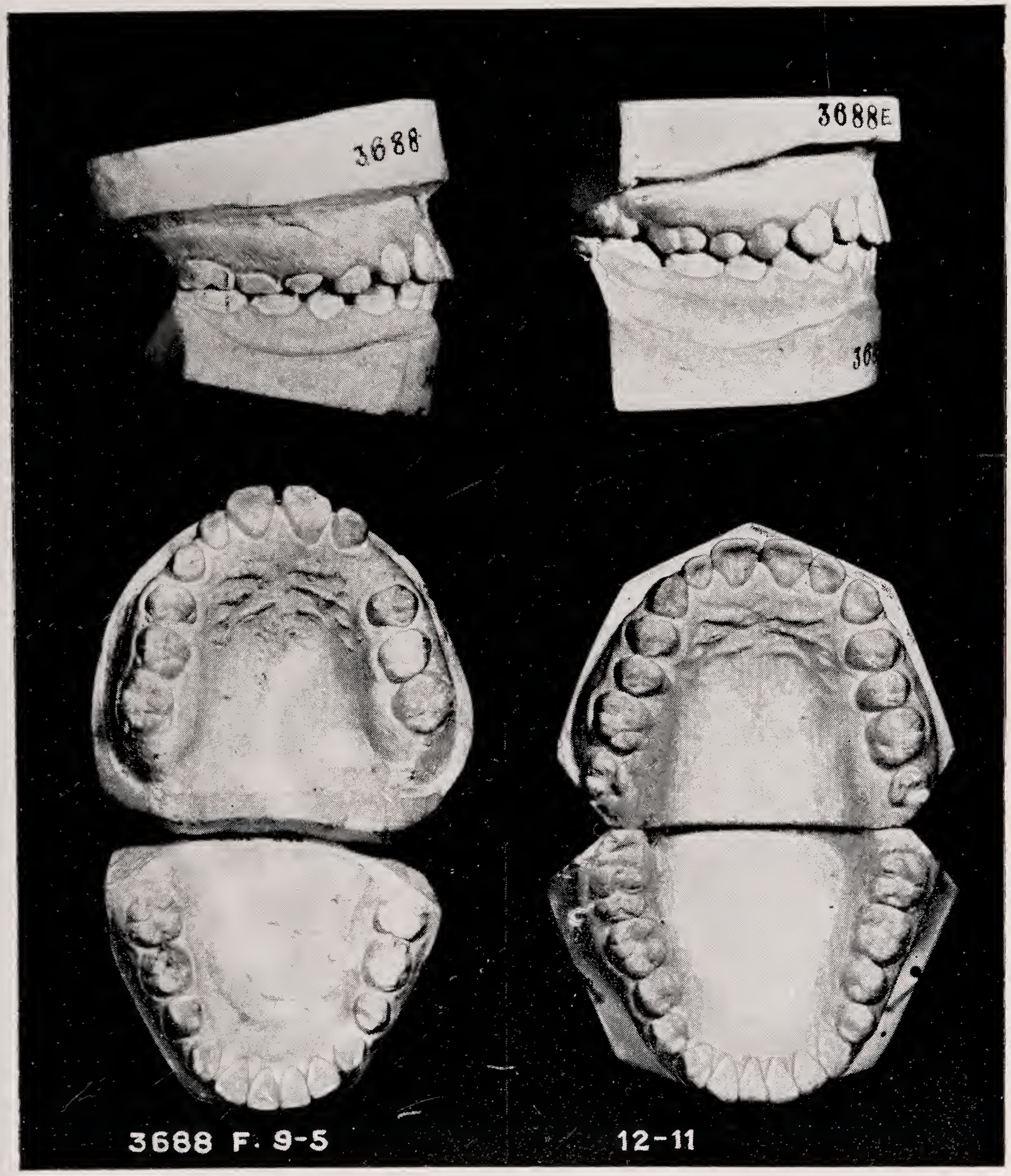

FIGURE 5.

Case No. 3688 *F. Age* 9-6

1. Dentition: $\frac{6e4c21/1234e6}{6e4321/1234e6}$
3. X-rays show: $\frac{53/\ 5}{5\ /\ 5}$ present.
5. Arches very good in normal relation.
6. Overbite: 2 mm. Overjet: 2.5 mm.
8. Incisor (a) alignment: very good: $\frac{c21/12}{e43\ /\ 34e}$ spaced.

   (b) relations: very good.
11. Normal occlusion with proclination of upper and lower incisors.
12. Fillings: $\frac{/e}{e/e}$ Caries: ? $\frac{\ }{6/6}$
23. Notes: Has twin brother with identical condition (Fig. 6)
25. Advised treatment be not undertaken but mother anxious for it and accepts the risk though advised prognosis very uncertain. Active treatment six months; retention two and a half years.

FIGURE 6.

Case No. 3689 M. Age 9-6 (Twin brother of Case No. 3688). Untreated. Normal occlusion: excellent arches: very similar to No. 3688 has the same double prognathism.

Mother did not wish for treatment.

in recent years, five with normal occlusion, and two with post-normal occlusion. All the cases have good arches, there is no crowding. The diagnosis, treatment, and prognosis are based on clinical evidence alone. The details of the cases (Figs. 3 to 9) are in the legends, being extracts from the charts, except Figs. 7 and 8 for which the charts themselves are used. (These charts are recorded on Tables which, for reasons of space we are, unfortunately, unable to reproduce.—Ed., D.R.)

The treatment and other details, if any, are recorded briefly in the text. I do not now use printed charts but a "key" which serves as a questionnaire and only items that are applicable are recorded. This would not be suitable for students, so I record one case on a chart formerly used in the London Hospital Dental School; the details recorded on the reverse side of this are also recorded on the private practice chart, so that one knows at a glance when major details of treatment were carried out, e.g. impressions taken, bands cemented, appliances put in, inter-maxillary traction used, and any other apparatus employed.

Case No. 3688 (Fig. 5) Treatment:—

Age 9-6. Appliances: bands $\frac{6/6}{6/6}$: two upper arches with cleats $\frac{1/1}{}$ on the

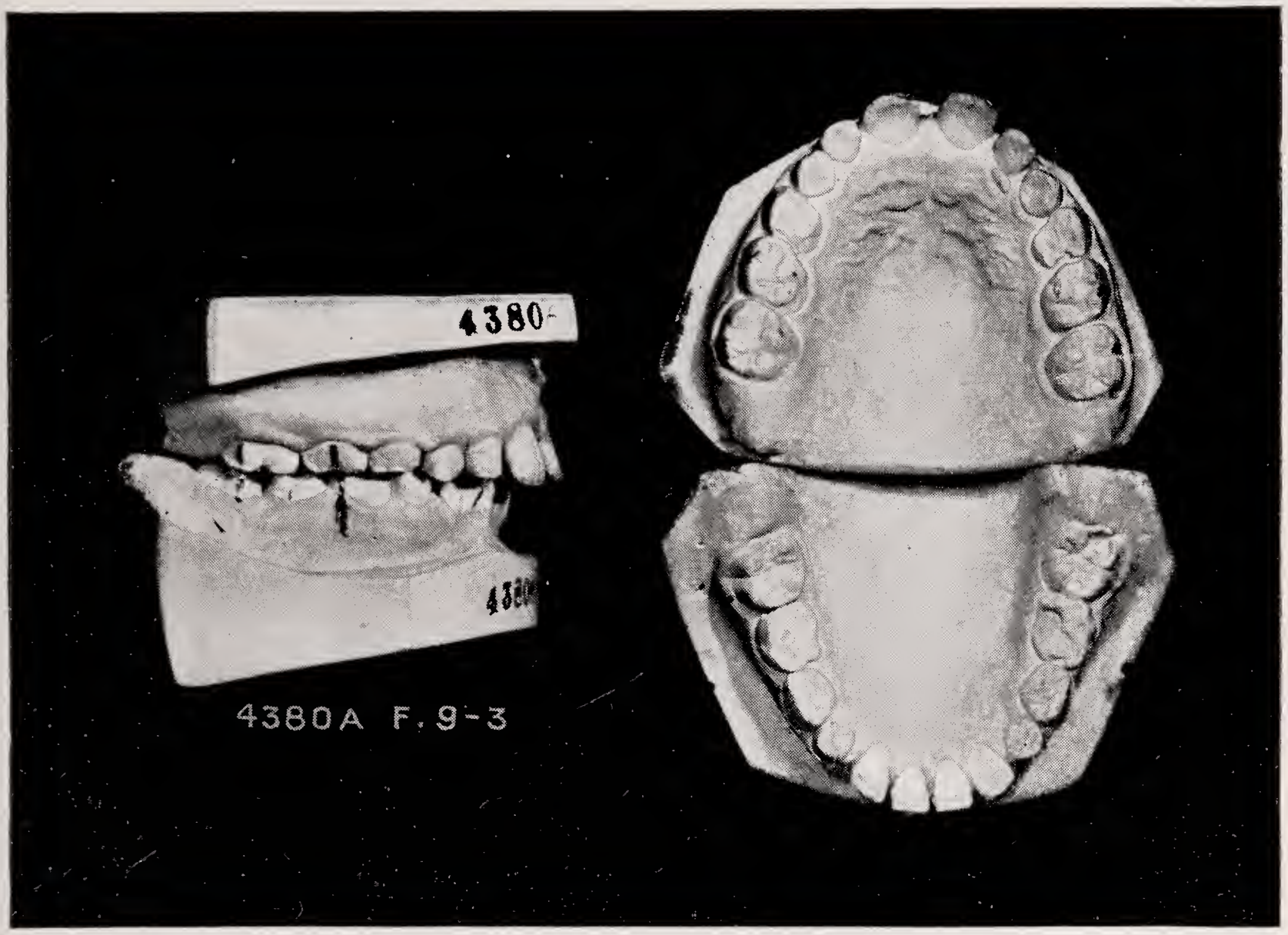

FIGURE 7

labial and lower labial arch, with thin wire section to engage 1/1 near the incisal edges; the labial arches have soft wire ends to engage the distal ends of the buccal tubes to prevent the arches being removed: 1/1 ligatured to arch. Intermaxillary traction from 3/3 area to 6/6 to retract 21/12.

Age 9-8. 21/12 in position; lower labial arch, ligated to 6/6 for retention.

Age 9-10. Intermaxillary traction to retract and correct the proclination of 21/12. 1/1 banded to attach labial arch for support. Vertical spurs 1/1 to keep them in at the incisal edges. Lower labial section (bottom of Fig. 7) to retain 21/12 (ligatures are preferable to this labial section but not so effective to retain the incisal edges).

Age 10-0. Upper incisors in position; removed bands 1/1.

Age 12-3. Removed lower appliance: overbite should prevent relapse of 21/12.

Age 12-9. Removed upper appliances.

Age 12-11. 1/1 slightly more proclination than at 12-9 but case excellent. Further appointment not kept: after two-and-a-half years mother was wishing appliances removed.!

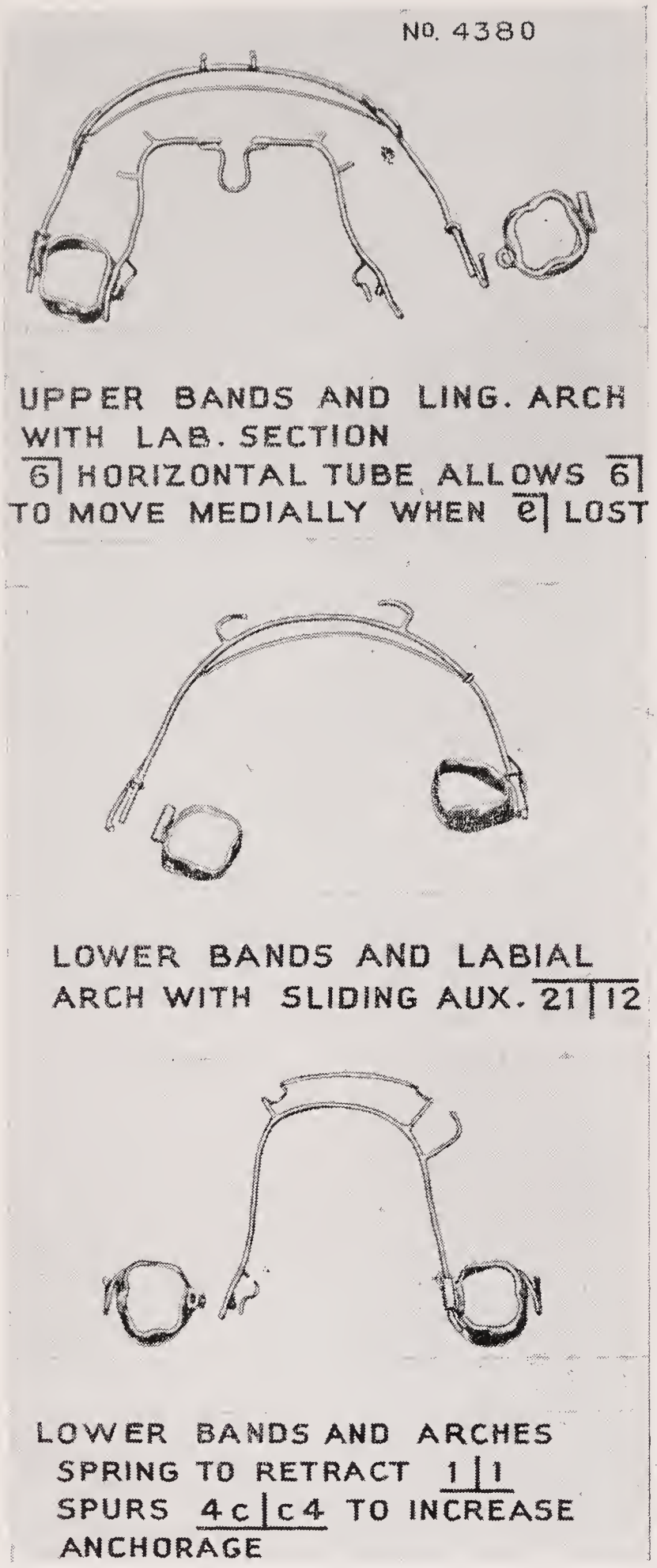
No. 4380
UPPER BANDS AND LING. ARCH WITH LAB. SECTION
6| HORIZONTAL TUBE ALLOWS 6| TO MOVE MEDIALLY WHEN e| LOST
LOWER BANDS AND LABIAL ARCH WITH SLIDING AUX. 21|12
LOWER BANDS AND ARCHES SPRING TO RETRACT 1|1 SPURS 4c|c4 TO INCREASE ANCHORAGE

FIGURE 7

Case No. 4380. (Fig. 7).

Marked improvement was obtained in two years in spite of *great* difficulties encountered as a result of breakage of fixed appliances and the almost hopeless task of arranging appointments; otherwise, one could not wish for a better or easier patient to work for. Latterly I endeavoured to keep a relay of appliances ready for insertion immediately a breakage occurred in order to mitigate these difficulties. When the case was all but ready for retention the parents decided to transfer the patient to another practitioner. The lower incisors were retracted with inter-maxillary traction (Fig. 7 two top appliances) as in case No. 3688.

Case No. 4601 (Fig. 8).

Excellent patient but very hard on appliances as a result of "playing with them" to which he confessed but for a time seemed unable to control these habits.

Age 10-8. Incisal relations good. Inter-maxillary traction night only.

Case No. 4599 (Fig. 9) Treatment:—

Age 9-1. Bite opened slightly by lower plate (as in Table 3) occluding with upper deciduous molars to remove pressure on 1/1; the amount the bite was opened was increased from time to time; plate, cut away from 21/12 lingually, carried a looped labial wire, with or without a sliding auxiliary spring, used to retract them. There were various interruptions to treatment but appearance of 1/1 seemed improved by the indirect treatment; mother expressed herself pleased.

Age 9-8. Plate not worn all of 24 hours.

Age 10-1. Plate discarded, 3/3 erupting unusually lingually.

Age 10-8. 3/3 in better position; new lower plate to maintain the result and keep spaces; these not reduced further.

The conclusions to be drawn are that cases which include post-normal occlusion (Figs. 7 and 8) should be treated, but that those which are examples of normal occlusion with proclination of upper and lower incisors are in a different category—some definitely do not warrant interference

(Figs. 3 and 4). The case shown in Fig. 4 may improve naturally; other, such as Figs. 5 and 6 should only be treated if the parents are really anxious for treatment and are prepared to go through with it and the orthodontist advises it, maybe with qualifications, in the cases of the twins, the mother was most insistent for treatment for the girl but not for the boy; yet, in the case of the former, was pressing for its discontinuance at too early a stage; after the appliances were removed the patient was seen only once. Treatment in such a case is a matter to be decided between parent and dentist: personally, I am doubtful if correction of the proclination of all the incisors will be successful if undertaken after the roots are fully calcified.

A different type of case is shown in Fig. 9; treatment is indicated if the cause is a local one and its effects can be overcome.

To bring treatment to a successful conclusion requires the patience of all concerned. In two cases it vanished all too soon—a factor always to be borne in mind whatever the protestations before treatment is begun.

Sir Robert Hutchison, Bt., M.D., F.R.C.P., (1951) in an article "Hospitals Fifty Years Ago" refers to diseases, e.g. chlorosis, which were common before the period he writes of; of other diseases e.g. typhoid, common then but rare now, and of yet others which are common now but were rare fifty years ago. There are changes in dentistry too, and one may enquire if in orthodontics there is some such trend. Professor Sprawson has mentioned that saddle-shaped arches were common fifty years ago; probably few practitioners of even twenty years' standing have seen such a case; it is possible that acromegaly, one of the features of which is prognathism, to which Mr. R. E. Rix

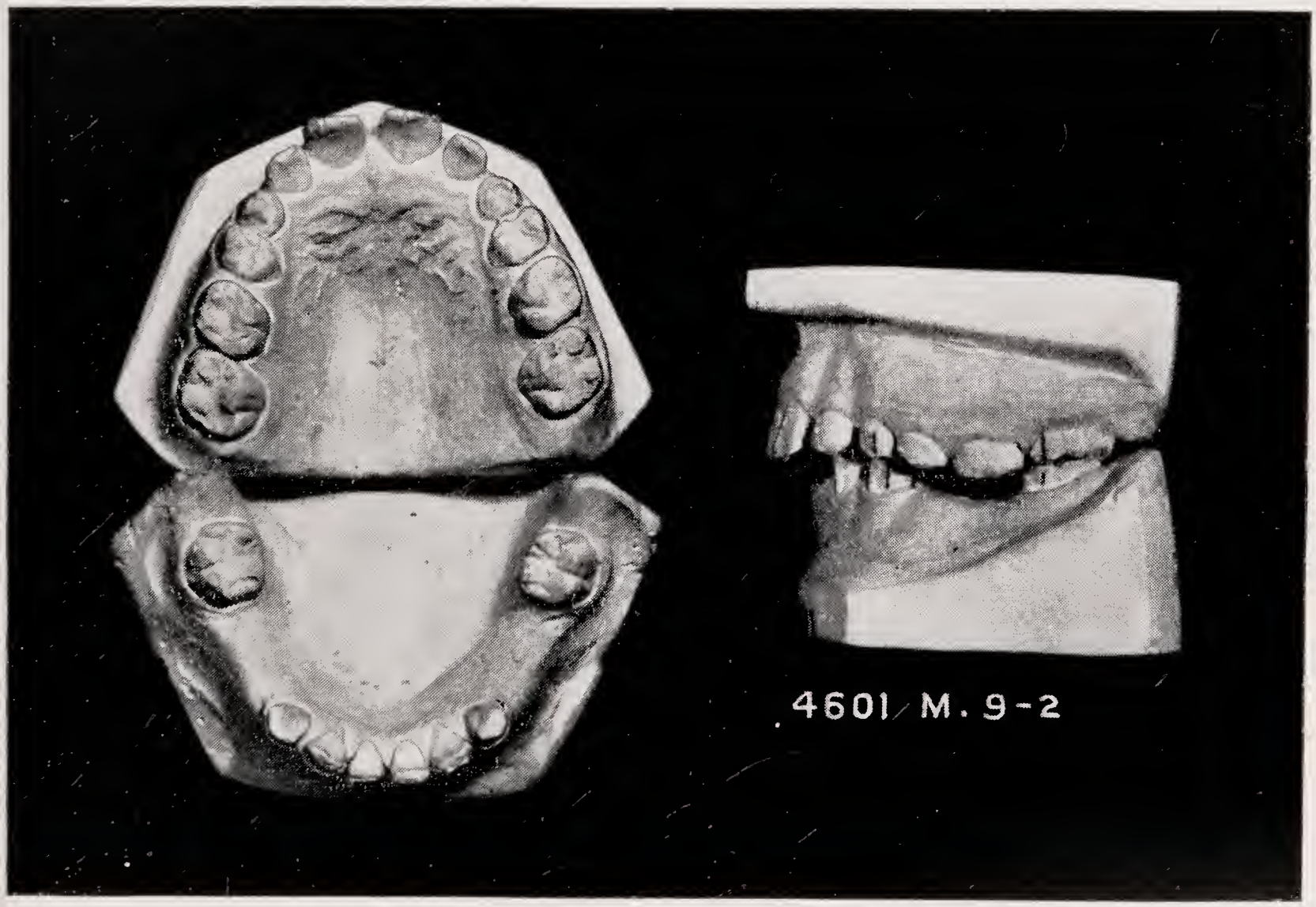

FIGURE 8

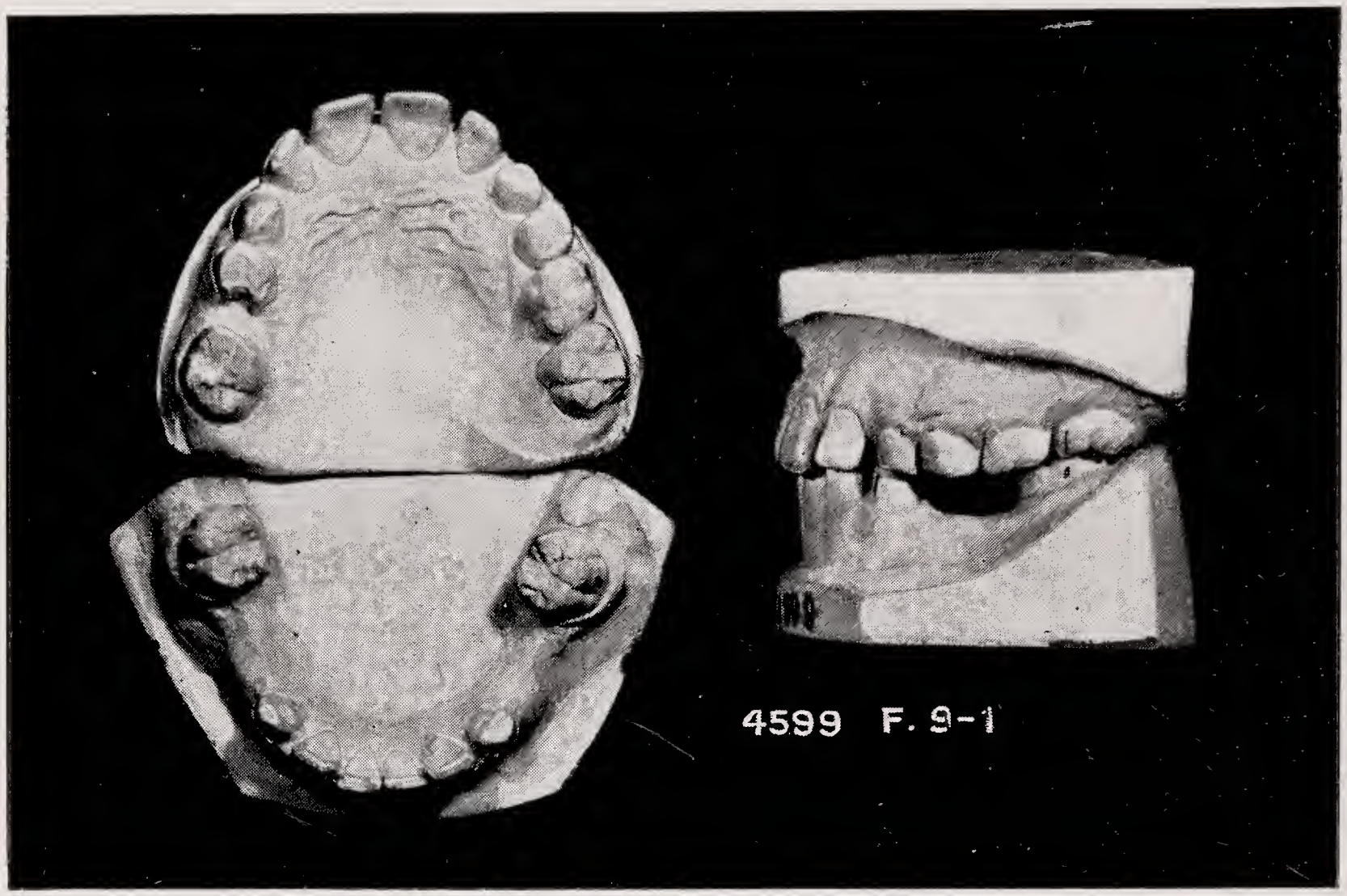

FIGURE 9.
Case No. 4599 F. Age 9-1

1. Dentition: 6 dc21/12cde6 / 6 c21/12c 6
2. Premature loss e/ / ed/de
3. X-rays show: 7 543/345 7 in good positions. / 7 543/345 7
5. Very good arches.
6. Overbite: 4 mm. Overjet: 3 mm.
8. Incisor alignment upper and lower very good: upper and lower incisors proclinated.
9. Medial drift 6/ and $\overline{6/6}$ (slight: the normal amount but premature; no more should be allowed): distal drift dc/.
10. Reduced spaces: $\overline{5/}$ reduced to 3.5 mm. (/e=8 mm.): $\overline{54/45}$ 13 mm. (average ed 17.6 mm. 54 14 mm. (Black) just enough room for premolars.
11. Normal or Class 1.
12. Fillings: Nil. Caries: Nil.
14. General condition of mouth: very good.
17. Physical characteristics of: (a) Body: medium. (b) Physique: good. (c) Width 1/: 8.5 mm.
20. Etiology: errors due to premature loss deciduous teeth, e.g. loss of spaces and ? bite closure followed by proclination of all incisors.
23. Notes: patient brought because mother suspected 21/12 becoming proclinated, which seemed possible.
25. Treatment: Lower plate to open bite, remove pressure on 1/1 and retract 21/12 (as shown in Table 3).

also referred at the meeting of the British Society for the Study of Orthodontics, November, 1951, is on the increase, even though the cases are only mild? It is interesting to speculate if double protrusion is also on the increase.

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DISCUSSION

Mrs. E. G. LINDON said that she would like to thank Mr. Chapman for asking her to open the discussion on his Presidential Address, which she thought was most interesting.

She considered that there was a difference between prognathism and protrusion. Anthropologically, prognathism was described as the excessive prominence of the facial skeleton in relation to the cranium, whereas protrusion described the increased axial inclination of the teeth, which caused their surrounding dento-alveolar structures to become more prominent, and proclination described the condition more accurately than did protrusion. Therefore double prognathism was probably an inherited condition in itself, whereas a double proclination was more likely to be the result of an acquired or inherited muscle pattern, the muscle pattern having caused or contributed to the proclined position of the upper and lower teeth.

Mr. Chapman had mentioned the two apparently conflicting statements made by Björk; first, that there was an increased prognathism of both jaws together with appreciable changes in the profile, and, secondly, that alveolar prognathism diminished during growth.

With regard to the increased prognathism, Björk said that it was due to the changes in linear dimensions, and the two reasons he gave were that there was a greater percentage increase in jaw length compared with the length of the cranial base and that the percentage increase of the ramus was twice the increase in the

length of the body of the mandible. As to Björk's second statement, she would suggest that the decrease in alveolar prognathism, by which she understood proclination, between the ages of 12 and 21 years, might be due to an improvement of the lip posture occurring between those ages, which might cause the upper incisors, at any rate, to become less proclined'

The aim of orthodontic treatment of cases of double prognathism, as in other orthodontic cases, should be to produce an aesthetic improvement and to establish the best functional occlusion possible for the given apical base relationship and an occlusion which was in equilibrium with the musculature.

If muscle action was the cause of or a contributory factor in the production of double proclination, the success of the treatment would depend on the manner in which and the degree to which the muscle action could be altered.

Treatment, if undertaken at all, generally consisted in the retraction of the upper and lower six anterior teeth, with or without the extraction of the four first premolars, in order to collapse backwards the anterior segments of the dental arches and so reduce the prominence of the lower third of the face, but the fact that prolonged and sometimes indefinite retention was necessary suggested that the teeth were not stable with the surrounding musculature.

In conclusion, she would like to ask Mr. Chapman whether, during the prolonged period of retention in the case of the $9\frac{1}{2}$ year old twin sister in Fig. V, he had noted any alteration in the muscle action, and whether he had had an opportunity of examining the twin brother in order to note whether or not there had been a spontaneous improvement in the musculature and incisor inclination.

The PRESIDENT said that in the first case which he had shown he would not have liked to risk taking out any teeth at all, for fear that he would make the case worse rather than better.

In the case of the $9\frac{1}{2}$ year old twin girl, he had not given any instructions with regard to the musculature, and he did not think that he had ever seen the twin boy again. The case had been a very disappointing one.

He was grateful to Mrs. Lindon for explaining the anthropological differences with regard to proclination and bimaxillary protrusion. He had referred to that in the complete Address, of which he had read only excerpts. He had left out some quotations from Björk, and he was grateful to Mrs. Lindon for including those in her remarks.

Mr. J. H. GARDINER said he thought the President should be congratulated on choosing the subject of prognathism for his Address. There was certainly a great deal still to be learned about it.

He did not know what was the case in other areas, but in South Yorkshire there seemed to be a prominence of the lower jaw; in fact, in one district it was commonly known as the Barnsley jaw. In his records, however, he had found only one case which he claimed to be a bimaxillary protrusion.

(*Slide*)

The slide showed that case, which was of a girl of 12 years of age. The arches were overcrowded; the bases were in a normal relationship and the occlusion was Angle Class I. It was decided, in view of the mesio-inclination of the canines, to extract the four first premolars.

(*Slide*)

The slide showed the case 14 months later. During that period the patient had been wearing a mouth screen, but he did not think that she wore it a great deal. She was still under treatment.

(*Slide*)

The slide showed a comparison of the two conditions, before and afterwards. It could be seen that there had been a shortening of the length of the arch by about 3 mm.

He regretted that he had no photographs of the patient and no reliable X-rays, from which it could be seen whether the reduction was due to an actual distal movement of the anterior segment or to a mesial movement of the posterior segment, or to both.

In another case a man of 45 years claimed that his anterior teeth were becoming more and more prominent and spaced, and on examination he proved to have a pyorrhoetic condition that was reducing the alveolar bone supporting his anterior teeth. He also seemed to have a very powerful tongue, and he said that his job consisted in applying his tongue forcibly to the lingual surfaces of his anterior teeth, as he was the leading trumpeter in a dance band.

He did not know what the experience of other orthodontists was with regard to the part played by the tongue in producing prognathism and he would be glad to hear about that. He would also like to know whether the overcrowding or the spacing of the teeth could be regarded as an indication of the part played by the tongue. For instance, if both arches were spaced could it be assumed that the only reliable way of getting a stable result was actually to reduce the size of the tongue surgically?

The PRESIDENT thanked Mrs. Lindon and Mr. Gardiner for opening the discussion on his Address.

The case which Mr. Gardiner had shown was of a different type in a sense, in that the apical space was small for the teeth, whereas in the cases which he himself had seen that had not been so at all. He would agree that in Mr. Gardiner's case the premolars should be removed, and he thought that their removal had made a remarkable improvement. He imagined that, whilst there must be some medial movement of the back teeth, there would also be movement of the upper central incisors and therefore of the lower incisors lingually which helped the condition to improve.

He would leave Mr. Watkin to deal with the question of the tongue.

Mr. H. G. WATKIN said he agreed with Mrs. Lindon that a good deal of the proclination of the teeth must be due to the musculature. The teeth took up a position of equilibrium between the inward force of the lips and cheek and the outward force of the tongue. Had Mr. Chapman thought about reducing the size of the tongue in the cases which he had had difficulty in correcting? He had noticed that the D's were out on one side, and one would expect the incisors to travel distally, but they were still forward, owing to the pressure of the tongue. The internal pressure pushed the incisors out, and one put in an appliance and pushed them in, but if one removed the appliance they relapsed. If a section of the tongue were removed no appliance would be necessary.

Mr. R. E. RIX said he would like to thank the President very much for his interesting address.

There was an illustration in Björk's "The Face in Profile" which he thought might serve to smooth out the apparent contradiction in his remarks. It was a superimposition of two profile X-rays, 12 and 21. In noting the relative inclination of the upper and lower incisors, one saw that there was a reduction in the proclination of the incisors, and at the same time the line joining the nasion on to the mental point in the two superimposed tracings did not move forwards in parallel; it broadened towards the chin. Therefore the individual had more mandibular prognathism at the same time as his upper and lower front teeth had become more retroclinated.

The PRESIDENT said he presumed it was the same one that was in the *Dental Record*. He understood that Mr. Rix thought that the chin had come forward.

Mr. R. E. RIX said that was so. He thought that Björk had been loose in his terminology and had confused many people in that way. In one instance

Björk was dealing with proclination of incisors and in the other he was talking about basal bone.

Mr. D. F. Glass, referring to apparent prognathism at 6 years of age, suggested that the movement forward of the mandible which produced the apparent prognathism might be due not to wear of the teeth but to proliferation of the cartilaginous head of the condyle at this springing up growth period, mentioned by Professor Harris, which was so common when epiphysial plates produced length of bone instead of width . The maxilla was a different type of bone however, and did not grow from cartilage at the time in question or at any other time. Therefore the growth of the maxilla and the mandible at that springing up period is different.

The distance between the foramen in front of the cuneiform plate of the ethmoid and the nasion increased about 1·5 cm. during growth; in other words, if one was going to measure prognathism of the face from the nasion at the age of, say, 4 years and then again at the age of 24 years, one had to cope with a distance of about 1 cm. in the movement forward of the nasion.

The terminology about bimaxillary protrusion, and so on, was so loose that it had not been possible in all cases to know to what the President was referring, but that was not the President's fault. There was protrusion of the basal maxilla and mandible and protrusion of the dento-alveolar complex, two quite independent conditions.

He had been privileged to examine some skulls of different racial types with Professor Aitchison; the difference in skull interpretation in Anthropology and Orthodontics is of importance and quite different.

Professor Aitchison pointed out that contrary to the ideas of many orthodontists the Negro face had less basal bone than the white man, the dental arches alone being the only prognathic part. The angle of the incisor teeth to the Frankfort Horizontal plane in Negros was quite outside the normal for white men.

Therefore to suggest that the proclination of the lower incisors should be a certain angle and depended on muscle posture might be correct provided it was stated whether the patient was a Mongol, Negro or other racial type.

The President said that in his address he had stated that he used the terms "bimaxillary protrusion" and "double prognathism" as being synonymous, and he thought that Björk used them in that way. He supposed that most of the members had read Björk's articles, which were of considerable interest to orthodontists, quite apart from their cephalometric aspect. Björk pointed out that when one examined cases individually one might get a different result from that which one obtained when one examined a large number grouped together. That was a little disconcerting statistically. Björk said, however, that between the ages of 12 and 20 there was a forward movement of the mandible, and he imagined, on reading Björk's paper, that Björk meant that the occlusion of the lower teeth with the upper also was more forward. He himself did not know whether that was due, as Mr. Glass had said, to growth of the condyle.

Miss L. M. Clinch, referring to the remarks made by Mr. Glass, said that she had seen many hundreds of Lapp skulls in the Oslo Museum, and they showed very well the labioclination of the upper and lower incisors, which was obviously quite normal for that race.

Having completed her term of office as President, she would like to thank Mr. Chapman very much for instituting the practice of discussing the Presidential Address. She thought that was a very good idea.

Mr. R. E. Rix proposed a vote of thanks to the President for his stimulating Address. The members, he said, had come to look for valuable practical implications in any contribution which Mr. Chapman

made to orthodontic literature, and they had not been disappointed on the present occasion.

He also wished to say how pleased the members were that Mr. Chapman was again occupying the Presidential Chair, after an interval of twenty-seven years. Mr. Chapman had fathered the Society and the members were very grateful to him for all the work that he had done for it. They wished him good health and success in his present year of office.

The PRESIDENT, in acknowledging the vote of thanks, said that he felt his Address had not been very helpful. He had found the subject a most difficult one to deal with, as the evidence was so unsatisfactory. He did not remember seeing any cases of double prognathism before the war; it was less than ten years since he had first seen any of the cases to which he had referred in his Address.

Any work that he had done for the Society he had been very happy to do, and he was glad to know that the members had appreciated it.

Orthodontics in Australia, The United States of America, and Great Britain—A Comparison

Dr. K. Adamson, d.d.Sc. Mel.

It is particularly pleasing to me to have been invited to speak to you for a short time this evening, as it affords me the opportunity of congratulating Mr. Chapman on the occasion of his occupancy of the Presidential Chair of this Society for the second time. Some twenty years ago I came to this country as a very young and a very raw youth. As I had spent twelve months studying orthodontics in America, I fondly imagined I knew all the answers. I have learned a great deal since then, and I realize now how very little I really knew at that time. In these circumstances, I realize that I was very fortunate to meet Mr. Chapman and Mr. Northcroft, who I am sure you will agree are two of the most outstanding personalities in the field of orthodontics in this country. They proved themselves two very kind and very wise friends to a young man in a strange country. Mr. Northcroft has passed on, but I am very delighted, Sir, to have this opportunity of wishing you a very happy and successful year of office.

The subject on which I have been asked to speak to you is a very large one, and since I did not receive Mr. Chapman's invitation to address you until after I had arrived in England, I feel that my talk may end something like the "Meanderings of Monty." Instead of an English accent you will have to put up with the typical Australian accent, which I am sure will disconcert you as well as amuse you. I did not intend to become involved in a discussion on the practice of orthodontics in this country if I could avoid it, but the President seems to expect me to say something on that subject. Perhaps I had better do that by answering questions afterwards.

In beginning to discuss orthodontics in Australia, America and England, one must have some bases for discussion, such as the appliances used, the philosophy of treatment, the aims and objects of treatment and the degree of success or otherwise of the treatment.

In Australia we have been under the influence of American orthodontics from the very beginning. My earliest teacher in Melbourne, Stanley Wilkinson, and Gates in Sydney who came before him, were products of the Angle School. I need not elaborate on the Angle philosophy of treatment—multiple banding and the perfect denture not mutilated by extractions. My early teaching and practice were influenced by that school of thought, and that influence was continued during my post-graduate training in America where I was fortunate enough to be taught by that great orthodontist and teacher, Robert Strang, at that time an ardent non-extractionist, although since then he has

Paper presented to the meeting on 14th January.

had the vision and the courage to change his mind.

Looking back in retrospect I realize that as students we gained the idea that orthodontics was something which was above us, and that any part of it was beyond the average dentist. We had to know something about it, but as for putting it into practice that was a different matter. We were taught the use of fixed appliances and every student had to do at least one case, but how we hated it ! We looked on it as a mass of bands and wires about which we knew nothing, and orthodontics came to be regarded as something which we had to take as part of the course but which had nothing whatever to do with the practice of dentistry afterwards. A more mistaken view I cannot imagine, because the fundamentals of orthodontics apply also to prosthetics, to conservative dentistry, to oral surgery and to parodontia.

I have been in charge of the Orthodontic Department of the University of Melbourne for fifteen years, but only in the last few years have we seen the wisdom of dispensing with the teaching of fixed appliances to undergraduates and getting down to those fundamental things which really matter. Therefore we orthodontists in Australia have, by and large, been Angle men. In the whole of Australia we have only twenty-seven specialists, and few general practitioners are interested in orthodontics. They usually say: " I do not do any orthodontics; I always send those cases out "; this is a bad thing if we are going to be faced, as I think we are, with a scheme of mass orthodontics in Australia in the not-too-far-distant future.

During my recent visit to America it did not take me very long to discover that there is not much interest taken in " orthodontics for the people." It is still " the ideal treatment for the few who can pay for it." It is true that there is a larger number of specialists in proportion to the population than in Australia and as a result more people receive orthodontic treatment, but, as far as the masses are concerned, nothing has yet been done towards meeting their need. The general trend in America to-day is towards a simplification of appliances, which I personally think is a step in the right direction. There is also a move towards the use of a more delicate type of apparatus and a smaller amount of force, and I think that also is a good thing. It does not really matter what type of appliance we use so long as the ultimate end of our treatment is successful. However, I am convinced that there are certain types of cases, such as Class II, Division 2, and advanced Class III, malocclusions that cannot be successfully treated without the use of multiple bands.

Some problems are peculiar to one country or another; for example, in Australia there are many more cases of mandibular prognathism than there are in this country, and certainly more than there are in America. I am told by orthodontists in England to whom I have spoken that there are more Class II cases here, perhaps more than are found anywhere else. There are no statistics on this subject, so it is difficult to prove the point, but, if one visits the pre-school division of the Melbourne Dental Hospital on a Saturday morning, it is quite common to find seven or eight cases of mandibular prognathism amongst thirty or forty patients between the ages of three and seven years. Again, teeth in Australia are so poor that many cases of malocclusion are either caused or complicated by the premature loss of deciduous teeth.

[Dr. Adamson then showed slides illustrating the points he had made, and commented thereon.]

Before my last trip to America I was under the impression that everybody there had dental treatment and that the public health education in that country was of a high standard. Yet the first day I was in Los Angeles I saw an article in the daily

press which said that 55% of the people there *never* receive dental treatment. On talking to some of the dentists and orthodontists, I found that in their opinion this was true, and furthermore they had the same problem as far as premature loss of deciduous teeth is concerned, although not the same trouble with the six-year old molars. I should be interested to know whether the dental condition of the six-year old molars in this country is as bad as it is in Australia. In my opinion these are the most important teeth in the mouth, and from choice I would never extract them, but we get many malocclusions to treat in which these teeth have already been removed, and so we have to do something about it !

[Slides were then shown illustrating this type of case before and after treatment.]

If we are to face up to the problem of mass orthodontics, we must have the general practitioner to help the specialist, and as yet I do not know how we are going to set about it in Australia. Here you have, by the system which your Society has always adopted, a general interest in orthodontics on the part of at least a certain percentage of the profession, but in Australia we will have to start from the beginning and build up. As I remarked previously, in recent years we have been keeping undergraduates away from bands and instead trying to interest them in the story of jaw and skull growth and dental development—a very interesting and amazing one. What could be more dramatic than the rise and fall of the human dentition ? Co-operation between the general dental practitioner and the specialist will solve our problem, but the general practitioner must know what he is doing. His estimation of a mouth's potentialities of growth is not any good if he does not know what to look for. An early malocclusion is so often missed, and often a normal developmental disturbance of tooth occlusion is mistaken for a malocclusion and treated unnecessarily.

In Australia some general dental practitioners take an interest in orthodontics, and a few who have taken a post-graduate course are doing very good work, but by and large those general dental practitioners who just dabble in orthodontics are liable to cause much trouble for themselves and the patients. However, early treatment by the general dental practitioner in the form of " denture guidance " is the only practical way of carrying out orthodontic treatment for a large number of cases, and therefore we must get the general dental practitioners trained in the fundamentals.

I have just returned from Amsterdam, where I paid a visit to the famous Nord clinic, at which 230 patients are seen in two and a half hours. One of the most valuable services rendered there is that a large number of children from the age of three to ten years, which all agree is one of the most difficult periods of the dentition, are seen at least once every three months for observational purposes.

A world-wide effort on the part of all is necessary to both qualify and clarify the position in regard to extraction. It is so easy to take out a tooth that is crooked, regardless of whether it is the right one or not. What may happen after the tooth has been removed you probably know, but many do not. A double alveolar prognathism, or what in America is called a " bimaxillary protrusion " (a bad term because it involves the mandible) should be anticipated, and extractions carried out at the correct time may provide a reasonably functional occlusion.

[Dr. Adamson then showed slides illustrating this point.]

I should now like finally to touch on the subject of cephalometrics. I know that it has been regarded in this country with a certain amount of caution, but I am sure that the future of orthodontics is closely

bound up with this subject. Many dogmatic statements have been made about cephalometrics by people who do not really understand it. It has been said that it is being used as a blue print for treatment. Others have said: "How can you assess treatment from the X-ray of a skull and say 'This I must do and this I must not do?'" "How can you measure in millimetres from an X-ray, which must vary a little and where you cannot see all the things that you think you can?" First, I would say that cephalometrics has never been meant as a blue print for treatment, and, secondly, that Broadbent who founded it, to my knowledge has never tried to measure changes in the jaw in millimetres. It was my privilege to spend a fortnight in the Broadbent-Bolton Foundation, and I can assure you that the work which is done there is completely honest and accurate.

I have with me some slides which were given to me by Dr. Broadbent himself, and were used by him recently at the Annual Meeting of the Edward Angle Society at Sky-Top, Pennsylvania. The Lecturer himself was opening a discussion on a paper given by Professor Brodie and Dr. Downes.

Most of Broadbent's remarks were directed towards criticism of these very points which I have just raised. For example, he disagreed with Dr. Brodie for making many of his measurements using only half the base of the skull from sella to nasion, instead of including a point on the base of the skull such as the Broadbent - Bolton point which gives a complete picture. He also offered some criticism of Downs for attempting to formulate skull patterns from a series of measurements on lines and angles. From the slides I am about to show you it will be seen that there is a danger in doing this. The various angles used by Downs in his analysis vary from time to time throughout the growth picture of one individual.

[Dr. Adamson then showed a series of slides illustrating these various points and discussed each one briefly.]

I am sorry that this has been such a sketchy approach to a subject which I regard as of great importance, but even leaving my remarks out altogether, I think you will agree that the slides alone constitute a very educational quarter of an hour. They are indeed the most beautiful slides of their kind that it has ever been my good fortune to witness.

I am afraid that my time has more than gone. May I thank you for a patient hearing, and I hope that you will overlook the many shortcomings which have been apparent and which have been the result of the hasty preparation of this lecture.

Discussion

The President said that Dr. Adamson had given a wonderful address and he was sure that no one present had been disappointed by it. There was ample material in the address for discussion, as Dr. Adamson had ranged over a very wide field. The meeting was particularly fortunate in having been shown the unpublished diagrams illustrating the direction of growth.

Mr. W. Trevor Johnson said that he would like to express his thanks to Dr. Adamson for the address, in which there was a great deal that he would like to discuss, but he would confine his remarks to two subjects.

Dr. Adamson had referred to the large number of true Class III cases in Australia. There was a sprinkling of them also in this country, and it was found that, whilst good results were obtained by treatment in the earlier years, they became increasingly difficult to treat as the patient grew older. He would like to ask whether Dr. Adamson had anything more to say about these cases than was known in this country.

With regard to Class II, Division I, cases, Dr. Adamson had said that he thought it was necessary to use a full band technique. In this country very good results were obtained by inter-maxillary traction in many cases without the use of bands on incisors and premolars, and he would like to know whether Dr. Adamson still found it necessary to use bands on these anterior teeth for these cases or whether he was avoiding them wherever possible, as was done in this country.

Dr. ADAMSON said that he had always believed in the early treatment of Class III cases. He had found that one of the greatest practical accessories to treatment was the use of a chin strap and head-gear. He did not think it mattered a great deal in which way one adjusted the occlusal relationship of the teeth, whether the appliance was fixed or removable, but he believed that a chin strap was essential (starting at as early an age as $2\frac{1}{2}$ years if possible), both before and after treatment with any type of appliance. He tried to persuade the patient, especially if it was a girl, to wear a chin strap up to the age of twenty; that was what he meant by the use of a chin strap after treatment. He believed that a true Class III case tended to relapse at puberty. It was a type of acromegaly confined to the mandible. A case which had been successfully treated would often relapse rapidly after the onset of menstruation, and would do so more slowly at puberty if the patient was a boy. That was why he tried to insist on the wearing of a chin strap.

True Class III cases must not be confused with pseudo Class III cases. A gross true Class III case was beyond ordinary orthodontic treatment and it was necessary to resort to surgery for its correction. There was a limit to the degree to which one could move the upper teeth forward, and it was a physical impossibility to retract mandibular teeth as a whole.

With regard to the question of Class II cases, he thought that perhaps he had not made himself quite clear. He agreed that good results could be obtained in the average Class II case without full banding. He had seen enough cases treated with Andresen appliances to be convinced that that was true, and good results could be obtained with the ordinary type of fixed appliance. In cases in which the six-year-old molar had been extracted, he thought it was very difficult to correct the position of the 7—to move it forward and restore correct vertical height—without multiple banding.

Mr. R. E. RIX said he would like to thank Dr. Adamson for his interesting address, which he had much enjoyed.

With regard to the excellent result that Dr. Adamson had obtained in two cases which he had shown early in his address, in which he had used fixed appliances " to restore the vertical height " subsequent to the extraction of the lower 6's, he would like to ask whether Dr. Adamson had extracted the upper 6's.

Dr. ADAMSON replied that all four 6's had been lost before he treated the case.

Mr. A. W. EASTWOOD said that he would like to thank Dr. Adamson for his very interesting paper and especially for his description of American orthodontics. In connection with the subject of the multiple banding technique as opposed to the trend towards the simplification of appliances, it was interesting to note that one man in California was using a combination of the two in his twin sliding section.

One fact which had interested him very much was that the University of Michigan had inaugurated a fact-finding clinic to study the part that orthodontics would play in a Health Service. That clinic had been in existence for over five years and was a joint effort by the University of Michigan and the Department of Health of the State of Michigan, and it had interested him to find that it was based on the observational technique; in other words,

an effort was being made to see what advantage there would be in examining children at an early age and examining them periodically throughout their school life, doing minimum of work for them as far as appliances were concerned. They might grind the deciduous teeth and put in a lingual arch or a simple bite plate, etc.

With regard to the question of cephalometrics, Dr. Broadbent disagreed with Downs chiefly with reference to the use of the Frankfort plane, because of the changing pattern of developmental growth of the face. Probably the mistake which had been made so far was that Broadbent had propounded a hypothesis in the use of the Bolton plane and everyone had taken the hypothesis as a fact. Perhaps Dr. Adamson would comment on that and say how he regarded the use of the Bolton plane. Did he agree or disagree with it, or had he an open mind about it? Was he open to the suggestion that another method of orientation might be found which would show a different pattern?

Dr. ADAMSON said that Broadbent criticised the Frankfort plane because one could not fix one end of it, namely Porion. That was partly due to the fact that it was obscured by the machine and partly because it was a very poor anatomical landmark when one came to look at the X-ray. Broadbent was well aware that there were some cases in which the vertebra almost occluded, or some shadows sometimes might occlude, the Bolton point and one had to do a geometrical construction to arrive at it in a satisfactory manner. In most cases one could achieve it with reasonable accuracy, but Broadbent was not satisfied with that; he still had an open mind, but he did not care what point was chosen on the base of the skull so long as it included the whole of the skull and not just the anterior part.

He was in complete agreement with Mr. Eastwood in regard to simplification of treatment. He thought the whole solution of the problem of orthodontics was to watch the development of the denture from an early age. That was the best thing that Nord had to offer. The Nord Clinic was a most important organisation, and, whatever criticism might be made of it, one could not disregard the fact that Nord was doing a great service by observing a large number of patients at regular intervals over one of the most difficult periods of denture growth. If that were done in more places, great good would come of it.

He had been interested to hear Carey's name mentioned. Carey's work was very well thought of in America and his new development with the D.R.11 was an important step towards the minimising of orthodontic force. Thomson of Pittsburg was working on a variation of the same idea, and he thought that it was a trend in the right direction.

Miss L. M. CLINCH said that she would like to thank Dr. Adamson very much indeed for a most interesting address.

Dr. Adamson had said that he felt that in this country orthodontists approached cephalometrics with caution, and she felt that he had been going to say " suspicion." She thought the reason for that suspicion or caution was that orthodontists in this country had had very little opportunity of using cephalometrics. Dr. Broadbent had traced case after case from 4 to 20 years or more, but she did not think that there had been a cephalometric machine in action in this country for more than two or three years, and she thought that the suspicion or caution had been due to the fear of drawing conclusions too soon from the work done in this country, not from what had been done in America, especially by Dr. Broadbent, whose work she thought was marvellous.

With regard to the education of undergraduates she had been taught, as an undergraduate and as a post-graduate, by an Angle orthodontist, and as an undergraduate she had been taught nothing but diagnosis. She had seen cases under treatment, but had not carried out any

treatment. Personally she thought that was a very excellent training. She had at least learned to diagnose and recognise orthodontic deformities at an early stage. She would like to know whether Dr. Adamson considered that that was a good way of using the limited time that an undergraduate had to spend on orthodontic work. There was a great deal of difference of opinion on that subject in this country, and she would be very glad to hear Dr. Adamson's views upon it.

Dr. ADAMSON said that Miss Clinch had read his mind correctly; he had been going to say "suspicion" but had thought better of it. He realised that orthodontists in this country, like orthodontists in Australia, had suffered from a handicap in that, owing to the war and for other reasons, they had not been able to use the cephalometer, but he wanted the British countries to keep pace with the Americans in this study.

He was entirely in agreement with Miss Clinch on the question of undergraduate teaching. Wiley believed that a dental student should make up his mind in his second year whether he wanted to become an orthodontist or not. In the North California School, those students who intended to become orthodontists did their dental course without any prosthetics and were taught orthodontics instead. He agreed, however, with Miss Clinch that students should not be taught too much treatment in the undergraduate course; they should be taught the fundamentals of diagnosis, and all that is possible in the time of growth and development. After, if they were sufficiently interested, they would come back to the school for post-graduate study and to learn treatment. That was the method adopted at the University of Melbourne, and it was not possible to cope with the applications for post-graduate teaching.

Mr. H. G. WATKIN said that he had enjoyed Dr. Adamson's address immensely.

The fact that general dental practitioners in Australia were flocking to the orthodontic courses showed how interested they were in orthodontics, and he thought it was a good sign for the future.

He would like to ask Dr. Adamson whether in Australia any resections of the jaw were done in Class III cases. This operation had been introduced into this country about twenty-six years ago, and had been performed many times since. It was very easily and quickly done; in fact, it was very easy indeed to push the jaw back, but it was difficult to pull it forward. He had not been at all successful with the chin strap. Cases which one had treated successfully up to the age of 13 came back about the age of 17, having relapsed into a Class III condition, the mandible having grown in the meantime, evidently due to hereditary influence.

Dr. ADAMSON said that resections of the mandible were done in Australia. They had not been done for very long to any great extent, but since the war a considerable number had been completed. Before the war plastic surgery in Australia had not been very well developed, but now Australia had many good plastic surgeons who had gained experience in this country during the war. The resections were very successful, but care must be taken not to do them too early; if they were done too early a relapse often occurred later on, and then there was nothing else that could be done.

Relapses in Class III cases occurred in Australia, and he agreed that heredity played a very big part. Until the introduction of the Tweed technique the treatment of Class III malocclusions was a rather "hit and miss" affair. Now 60% to 70% were successful, especially when a chin strap is used in conjunction with the fixed appliances.

Self-Correction of Premolar Spaces

H. E. Wilson, L.D.S., (QU. BELF.)

I WISH TO SHOW two cases where premolar space lost in the upper arch was reformed without treatment.

The first was a girl who had no interest in orthodontic treatment and attended the clinic because she was told to do so. There was some difficulty in obtaining the impressions. It was a natural decision, therefore, to keep her under observation, probably until the premolars erupted. The models were taken at about 18 months interval.

Fig. 1—Occlusal view. Models on the right show the original condition. $\overline{6}$ is rotated, $\overline{5}$ erupting. Space between $\overline{6\text{-}4}$ about 6.5 m.m. On the left side $\overline{6}$ is rotated more than on the right and $\overline{4}$ is also rotated, leaving a space between the disto-buccal corner of $\overline{4}$ and the mesio-buccal corner of $\overline{6}$ of about 1.5 m.m. Some slight loss of space in the lower due to extraction of d | d.

The models on the left show the condition later with $\overline{5\,4}$ in place and $\overline{5}$ almost in place: $\overline{6\,4\,6}$ have assumed a more normal position. Note $\overline{7}$ is erupting.

Fig. 2—Right side. First models at the bottom show relationship of first permanent molars which has improved in top model, although it is not very apparent in the photograph. The space of $\overline{5}$ has increased enough to allow the tooth to move into the arch.

FIGURE 1.

FIGURE 2.

A short communication presented to the meeting on 11th February.

FIGURE 3.

Fig. 3—Left side. Bottom models show relationship of buccal cusps of first permanent molars and the lingual occlusion of $\frac{|4}{}$. The top models show how the space has increased enough to allow $\frac{|5}{}$ almost into position. The relationship of $\frac{|6}{}$ has improved and the position and rotation of $\frac{|4}{}$ has also been corrected.

Fig. 4—Front view. Shows the appearance from the front; the space $\frac{1|1}{}$ has closed as would be expected. The remaining slight malposition of $\frac{|5}{}$ and the slight overjet was not considered serious enough to warrant treatment—the patient was very pleased.

FIGURE 4.

The other case was a child who with its parent was very keen to have orthodontic treatment.

The case was diagnosed as a mutilated Class 1: loss of premolar space in the upper by rotation of $\frac{6|6}{}$ and complete loss of canine space in the lower. Retroclination of lower incisors and deep overbite.

The line of treatment was to recreate room for $\frac{3\,3}{}$ and treat the upper later, probably with fixed appliances. An appliance was fitted in the lower but the child, in spite of her keenness, proved to be a " wrecker," so treatment was postponed until a later date, probably when the premolars were erupting.

Fig. 5—Occlusal view. Models on left show $\frac{6\,4|4\,6}{}$ rotated: $\frac{|5}{}$ space about 2 mm. and space between $\frac{6d|}{}$ about 4 mm.

Centre models show $\frac{5\,4|4\,5}{}$ in good positions and $\frac{4|4}{}$ erupting with insufficient room.

Models on right. All lower permanent teeth erupted in good positions. $\frac{|5}{}$ is a little short of room. $\frac{3|3}{}$ erupting: $\frac{|7}{}$ erupting.

Fig. 6—Right side. Models on left show space left for $\frac{5|}{}$; relationship of first permanent molars and retroclined incisors and deep overbite.

Centre models show improvement in molar relationship: increased space for

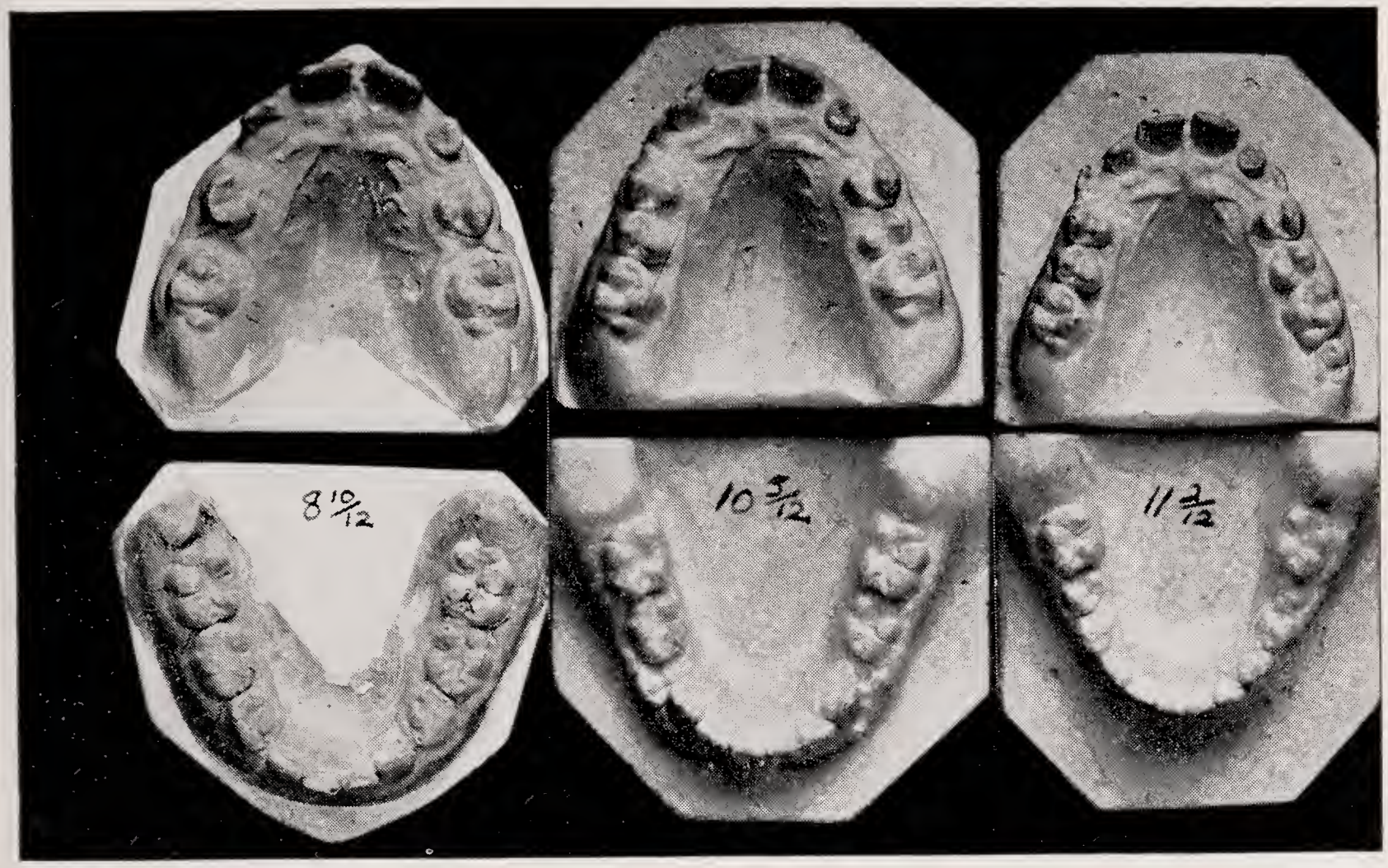

FIGURE 5.

$\overline{5}$ and sufficient room for $\overline{3}$: slight impaction of $\overline{4}$. Decrease in overbite.

Models on right: further improvement in molar relationship and eruption of $\overline{5}$ with improvement in $\overline{4}$ position and further improvement in overbite.

Fig. 7—Left side. Models on left show relationship of first permanent molar; lack of space for $\overline{5}$; deep overbite.

Centre models show eruption of $\overline{5}$. Improvement in molar relationship. Improvement in overbite.

Models on right show eruption of $\overline{45}$, further slight improvement in molar relationship and improvement in overbite.

Treatment continues.

Cases such as these are often treated with appliances to increase the premolar space.

FIGURE 6.

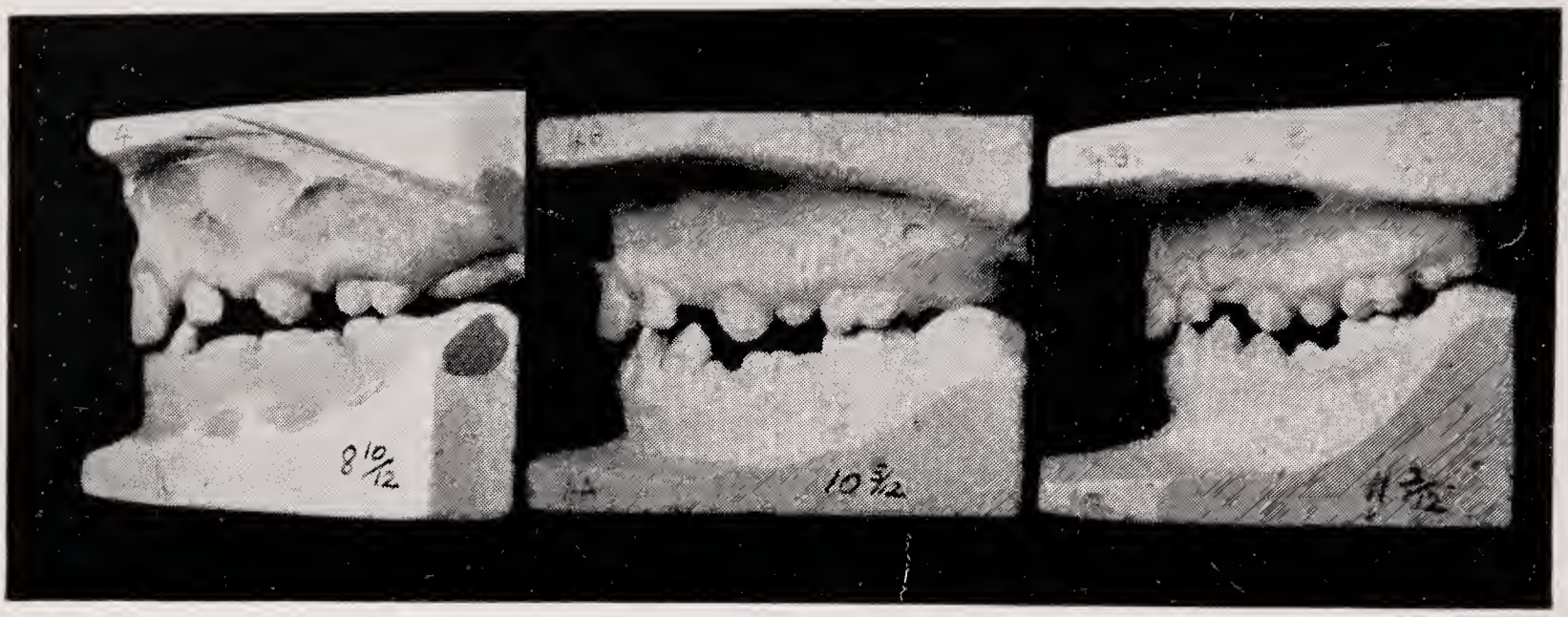

FIGURE 7.

In both, the space for 5 was reduced more than the space for 5 and in both cases the 5 failed to find sufficient room. Also, in both, the 7 was erupting while there was no sign of 7. I have seen other cases where 5 5 have been able to find room for themselves, and in most 7 7 had not erupted.

There may be similar cases reported, but I do not know of them. I consider these of sufficient interest to present to you and to be recorded.

DISCUSSION

The President said that Mr. Wilson had shown two most interesting cases. His Communication was a corollary to the paper given by Mr. Breakspear early last year. No doubt members would wish to discuss it.

Mr. E. K. Breakspear said that it seemed clear to him that the upper 6 was held back. It also seemed as though the lower premolars had made a fair amount of room for themselves in the second case. He wondered, however, whether the space might have been obtained at the expense of the 7 and 8. It was probably too early to answer this question, but he would be interested to know what happened to the 8 in ten years' time.

Mr. Leech asked to what factor Mr. Wilson attributed the reduction of the incisor overbite between the first and last models in the second case.

Mr. Watkin observed that Mr. Wilson had said nothing about the age at which the deciduous molars were lost. Early loss of the e's had a bearing in these cases.

Miss Clinch said that she had seen many cases where the space for the first premolar, after the premature loss of the first deciduous molar, had opened considerably. She thought that the opening of space for the second premolar was uncommon. As Mr. Wilson had pointed out, the reason was probably pressure from the erupting second premolar, and a great deal depended on the relative time of eruption of the second premolar and second molar.

The President said that in both cases one would be very much inclined to put in space retainers if one were watching them, or perhaps appliances in one case to restore the spaces. He was surprised to see how beautifully the teeth had aligned themselves. That they did that every

time he was not sure. He had two models of the lower (exhibited) in which the premolars had got in, but that was at the expense of the lower incisors.

One asked oneself how these teeth had got into place. In the first case the space between the two upper centrals and the incisors had closed. One expected that to happen but whether this helped to provide room seemed a little doubtful. Had Mr. Wilson any explanation as to why these beautiful results occurred without that happening? It would be very interesting to know. These cases showed how careful one should be not to institute treatment unnecessarily.

Mr. WILSON said, in reply, that he could add very little to what had already been said. Mr. Breakspear's suggestion was possible. On the other hand, if there had been a tendency to small arches and large teeth, he doubted whether the lower premolars would have got into the space in the first instance.

He could not explain the reduction of the overbite unless it was due to the build-up of the lower arch. The reduction of the lower arch produced an increased overbite, and the explanation might be that the premolars got in and forced the incisors labially to a more normal position. But this was just a possible answer to the question and he had no proof one way or the other.

In reply to Mr. Watkin, he said that he did not know at what age the deciduous molars were extracted in either of these cases.

Miss Clinch had said that the first premolars were not crowded out so often as the second premolars, and naturally if they were crowded out they had a better chance of getting into place before the eruption of the second premolars. But they did, and he had seen one case where the first premolar found its way in too.

In reply to the President, the pushing back of the upper molars was hypothetical. These were developing children, and as one understood development and growth, the teeth moved downwards and forwards. It was quite possible that the eruption of the 5's did not push the 6's back but prevented them from moving forward as they might have done otherwise. That was the only explanation he could give.

The Ideal Occlusion For Periodontal Health

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INTRODUCTION

The importance of occlusion in the aetiology of periodontal disease is still a controversial subject. Skulls of primitive man reveal that the excellent condition of his alveolar bone was associated with marked wear of the teeth. In many instances this wear permitted contact of several teeth in different segments of the arches during lateral and protrusive movements of the mandible—the balanced or " anatomical " occlusion. Chick (1952) referring to " closed movements " of the jaws states : " The number of teeth in contact will vary from individual to individual, depending upon the perfection or otherwise of his dentition. In a perfect mouth this varies between thirty-two and twenty according to the direction of the movement." He also maintains that this should be more a surface contact than a point contact. Adherence to the principle of balanced occlusion in the setting up of the teeth of full dentures usually improves their stability and comfort, but this is no argument for balance in a natural dentition.

The theory that the natural bite should be ground or built up to permit a balanced occlusion as a preventive measure for periodontal disease seems to be gaining in popularity. For example, Lindblom (1949) states: " Bite adjustment . . . (is) the sole effective prophylactic remedy against paradentopathy." A rationale for this view might be given by quoting Lazarus (1951): " The bones of the body are designed to take a longitudinal stress and very little horizontal movement. For this reason orthodontia can be performed with mini-

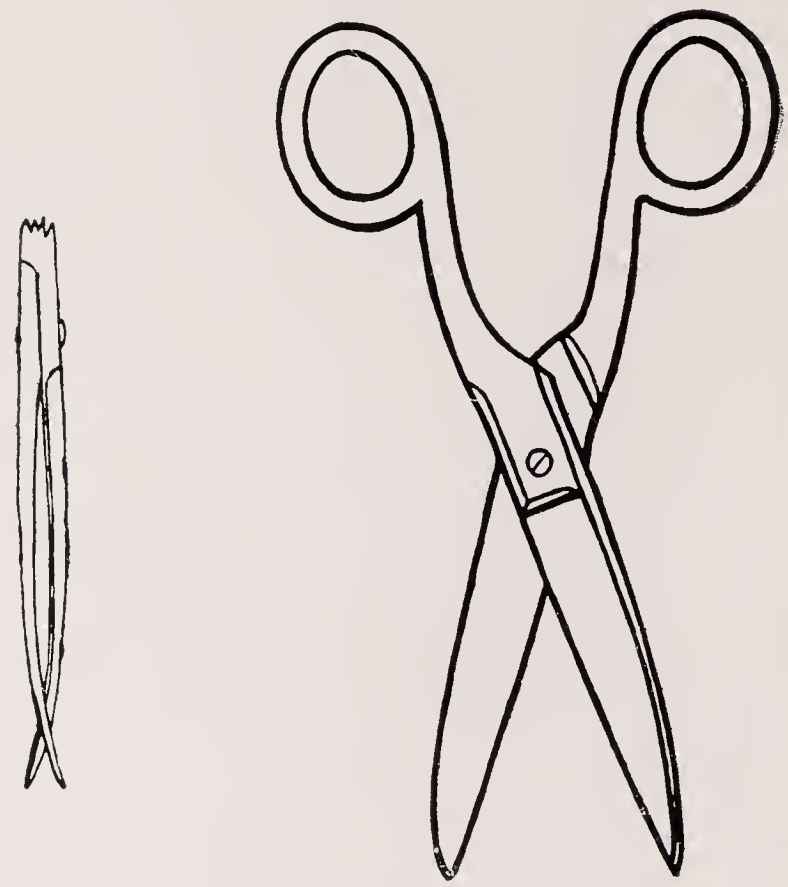

FIGURE 1
Two drawings of the blades of a pair of scissors. Note the curvature of the blades which permits a point contact only.

A paper presented to the meeting on 11th February.

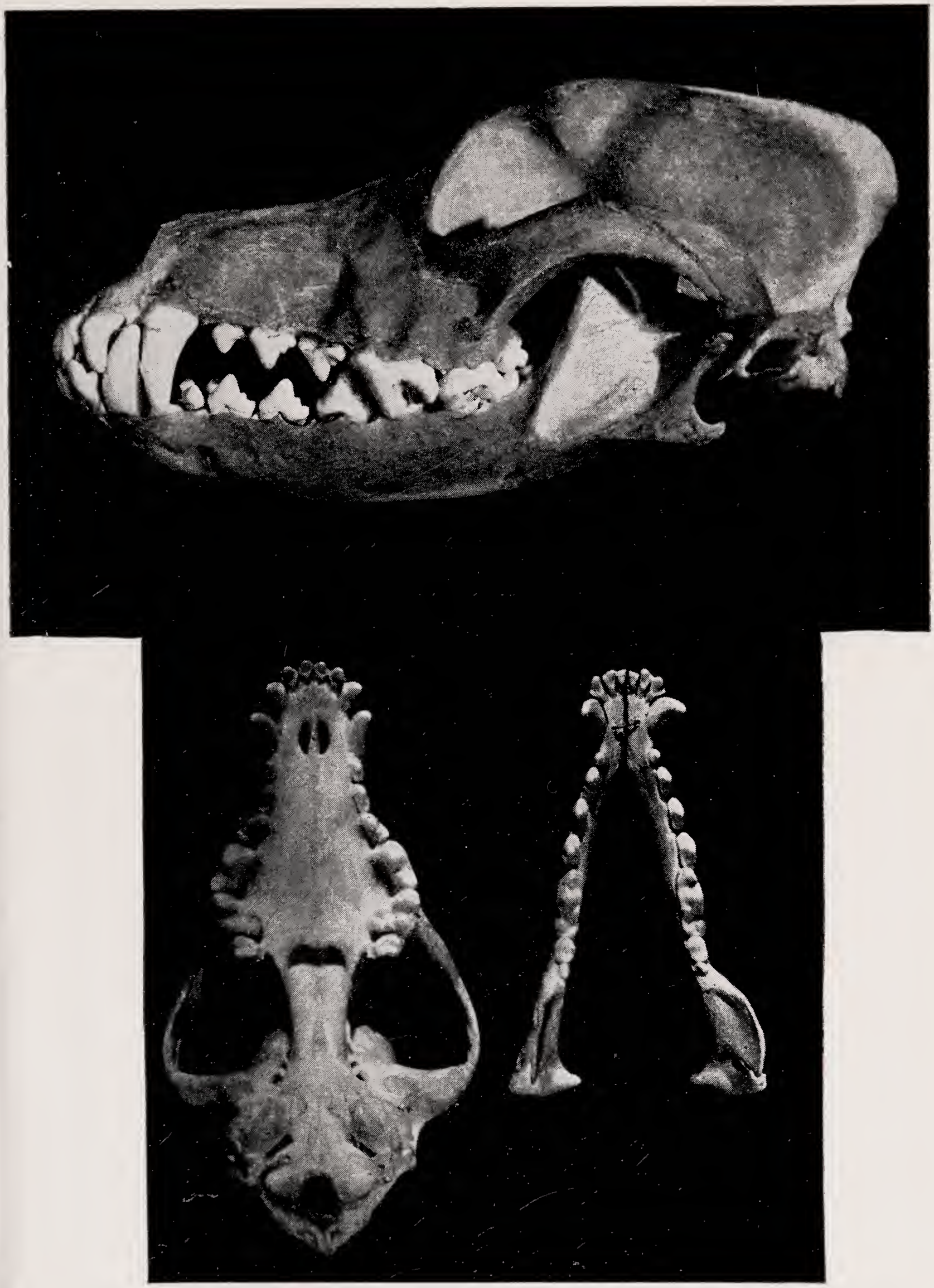

FIGURE 2

Photographs of a skull of a dog and a diagram (opposite) representing a frontal section through the carnassial teeth, A in centric occlusion, and B at the commencement of a shearing closure of the jaws. The upper teeth are shaded.

mal horizontal stress. Therefore, in grinding, it is desirable to cut down the horizontal forces and to produce a force that is in line with the long axis of the tooth."

We shall try to determine tonight whether the principle that the teeth should be subjected to only minimal horizontal stresses during mastication is sound. But first I would direct your attention to a simple mechanical cutting and crushing instrument, the scissors or shears.

THE PRINCIPLE OF SHEARS

A pair of shears is a " clipping instrument of two blades so pivoted or connected by a spring as to slide over each other edge to edge." Examination of the instrument reveals that during use the cutting edges have one point contact only, this point travelling from near the pivot to the end of the blades during each closure. Fig. 1 shows the curvature of the blades which is responsible for this point contact. Closure of the blades is permitted by a spring at the pivot, or the springyness of the blades themselves. To a large extent a pair of shears is a self-sharpening instrument. Chick (1952) has stated: " It is a well known fact that a shearing action is necessary for an efficient cutting of fibrous material." We shall now examine different types of dentition to determine how a shearing action is achieved.

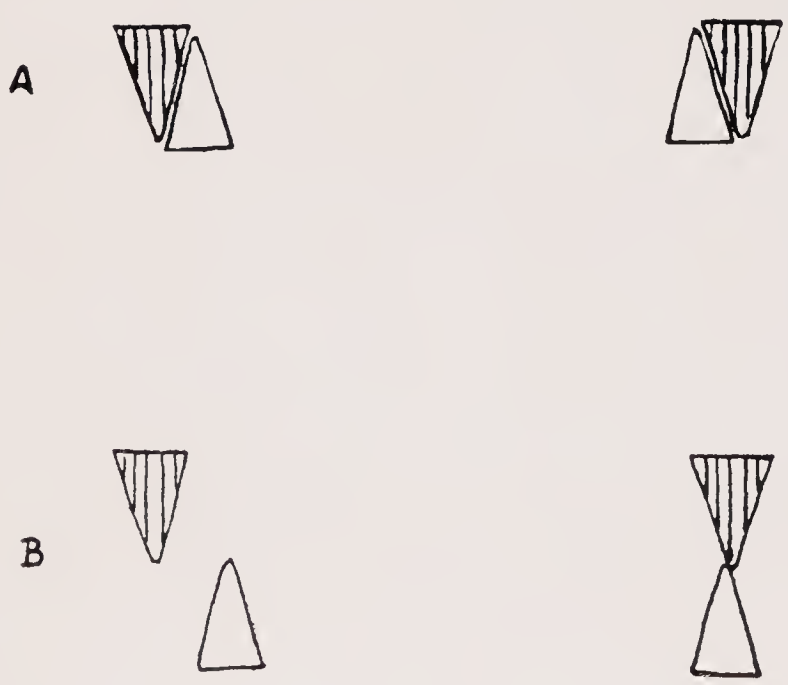

FIGURE 2.

COMPARATIVE STUDIES

(*a*) *The Dog*

The dog is a good example of a carnivorous type of dentition. The carnassial teeth of this animal appear to act as excellent shears. Study of the carnivorous type of T.M. joint shows that no forward movement of the condyle is possible, yet point contact of the cutting edges of the carnassial teeth is necessary for an efficient shearing action. This is achieved by a sideways translation of the entire lower jaw, produced by a sliding hinge movement at the T.M. joint (*Fig.* 2). This mechanism in the carnivorous dentition has been described by Brodie (1934) and Sicher (1944). To quote Brodie (1934): "A study of the temporomandibular joint in the cats reveals the source of the exact shearing action of the carnassials. The condyles are cylindrical in form and their axes lie in the same transverse line. The fossae embrace them so accurately that disarticulation is extremely difficult. It has been said that these animals possess a true hinged joint but this is not strictly true. When the jaws are closed the upper teeth lie completely buccal to the lowers so that if no lateral movement were possible there would be no contact between upper and lower teeth except at the instant that the jaws came to final rest. All requirements are met by the design of the joint which allows the lower jaw to be dropped and then shifted bodily to one or the other side, the condyles travelling in the line of their axes."

It should be noted that only one side of the jaws can be used as shears at one time. Another interesting observation is that edge to edge contact of the carnassial teeth is prevented by the canines which act as stops. Brodie (1948) has noted that carnivorous dentitions in which a canine has been lost show fracture of the carnassial teeth of the same side—presumably through these teeth meeting edge to edge. Balanced occlusion is, of course, not possible in the typical carnivorous denti-

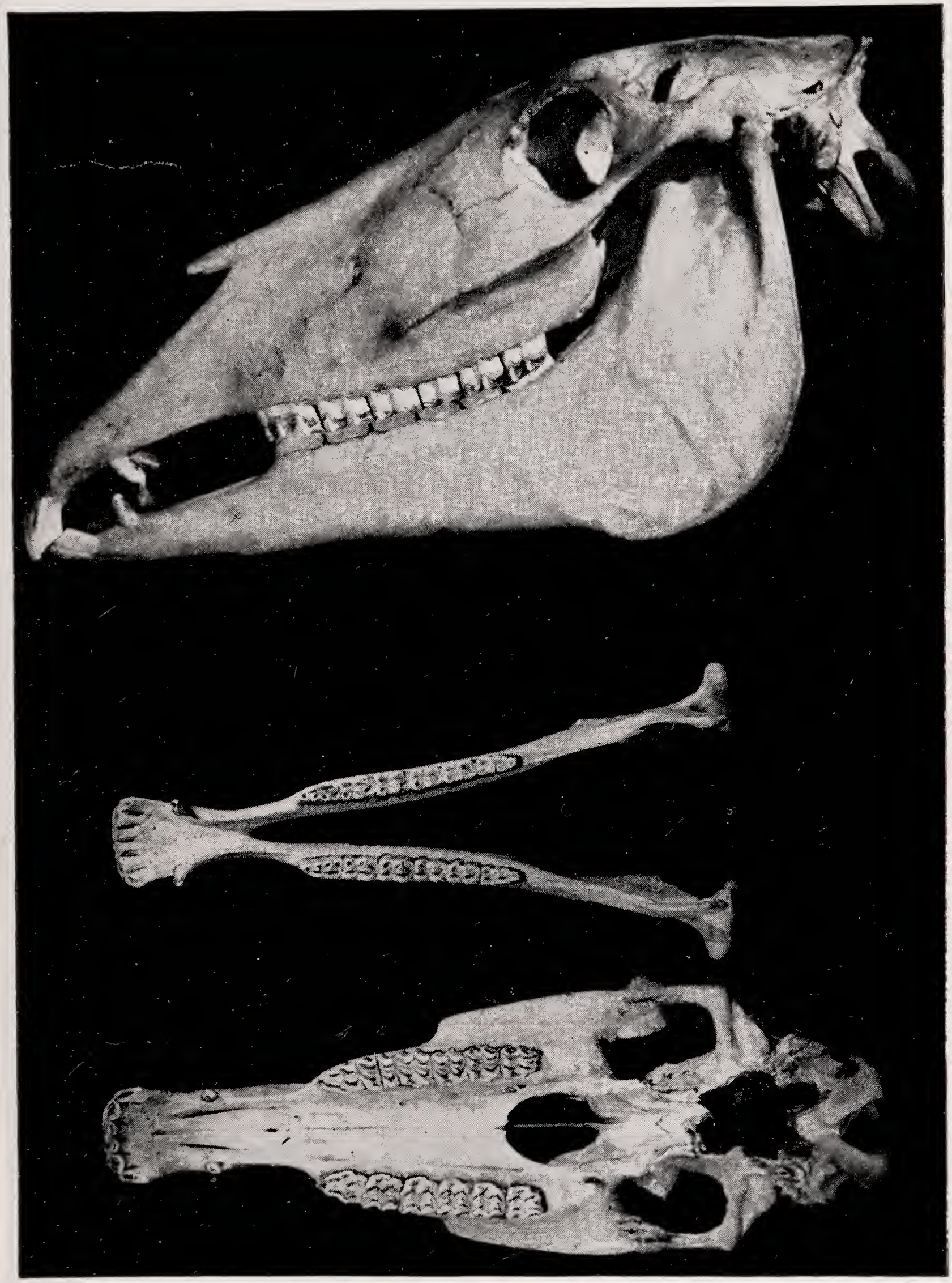

FIGURE 3

Photograph of a skull of a horse, and a diagram (opposite) representing a frontal section through the molar teeth with the jaws in centric position. Note that the mandibular molar teeth are almost entirely lingual to the maxillary.

tion.

(b) The Horse

The horse may be taken as an example of the herbivorous dentition. Here (*Fig.* 3) we see that the upper arch is wider than the lower, in which the cheek teeth are nearly parallel. Centric occlusion in this animal may consist of incisor contacts only. Yet the marked forward movements of the condyle which may occur with this type of T.M. joint permit wide lateral excursions of the mandible. During closed movements a whole series of enamel ridges on the molars comes into apposition and operates as a number of shears in a nearly horizontal plane. To quote Brodie (1934) again: "Function is unilateral and really consists of a wave of occlusion which starts in the back and travels forwards so that we might say that each tooth in turn receives the maximum load for the instant that the wave is passing over it." Balance with contacts on both sides of the jaws during lateral excursions is not possible with this type of occlusion.

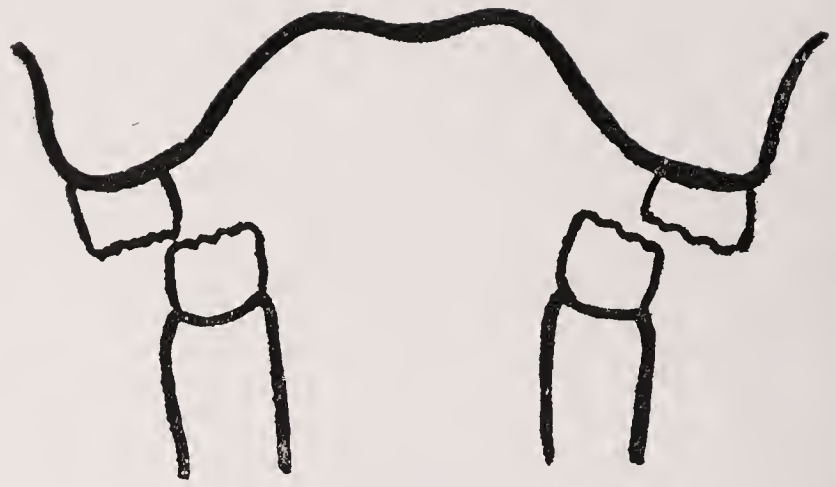

FIGURE 3

PRINCIPLES OF OCCLUSION

Consideration of these and other types of mammalian dentitions led Brodie (1939) to state: "Studies of comparative anatomical forms show that in no animal below man is bilateral function possible." He has also suggested (1948) certain principles of occlusion, which might be stated thus:

1. The segments of the arches function mainly as shears.
2. One segment only is used at a time.
3. In occlusal positions other than centric one tooth only in each jaw is in point contact at one time.

HUMAN OCCLUSION

Although man's dentition is omnivorous in type, in certain respects it is similar to the carnivorous. The shears are formed by the canines and buccal cusps of the cheek teeth. Lateral movements of the mandible are permitted by a forward movement of the opposite condyle, and a slight sideways translation, the Bennett movement. The first contact in an unworn or moderately worn dentition, when closing with a lateral deviation of the mandible, occurs with a cusp to cusp contact of the canines. As the mandible slides towards centric position, the buccal cusps of the premolars and molars in turn, come into point contact. Thus the effective cutting point travels from the canines backwards. This is caused by the decreasing height of the buccal cusps towards the back of the mouth (*Fig.* 4). No occlusion occurs on the other side of the mouth, but as the shears close, cutting the food, the whole of the strain is transferred to each tooth in turn on the working side. The healthy supporting structures of the teeth seem to be quite capable of taking the strain. Final crushing of the food occurs between the occlusal surfaces of the molars and premolars as the jaws close towards the end of the movement, usually centric occlusion.

PRIMITIVE MAN

The skulls of primitive man may show considerable attrition but do not necessarily show occlusal balance. In the part of an old English mandible shown in Fig. 5 the teeth have become so worn that they resemble the cheek teeth of an herbivorous dentition. The shearing action of this bite has become modified, being more

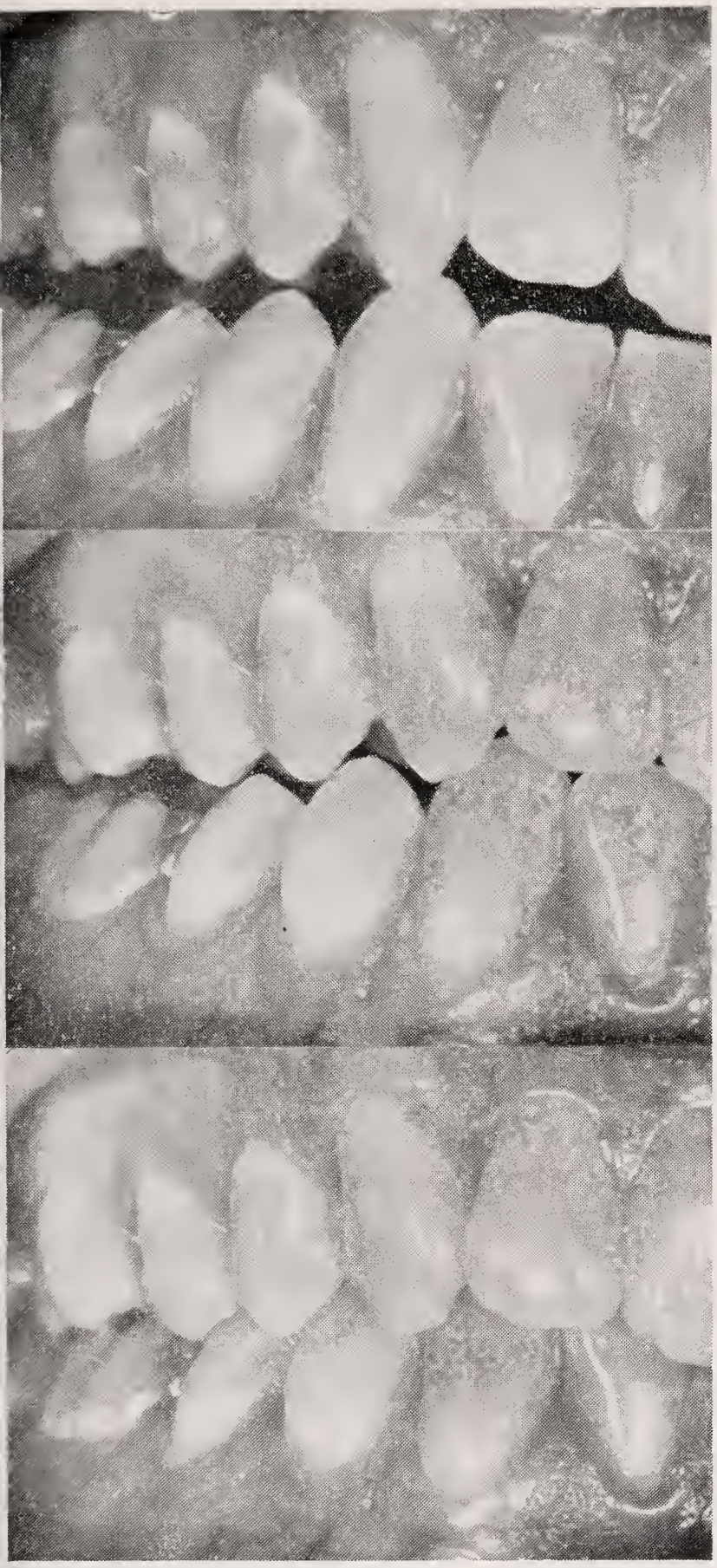

FIGURE 4

Three views of a slightly worn human dentition during a shearing closure of the cheek teeth on the right side. Successive contacts of the canines and then the premolars can be seen as the jaws close towards centric occlusion.

closely related to the herbivorous type of shear. On lateral excursions no balancing contacts on the opposite side of the jaws are found. During the process of wear of the dentition a time may come when balance occurs. But with further wear this balance may be lost. There is no reason to assume that this period of balance is responsible for the healthy periodontal condition which is often found in association with marked attrition of the teeth in primitive peoples.

THE EDGE TO EDGE BITE

Many of these ancient skulls show an edge to edge bite. This has probably developed as the result of marked attrition in a normal occlusion, and does not necessarily mean that the relationship of the jaws has changed during recent evolution. It has also been assumed that this edge to to edge relationship of the incisors is beneficial for periodontal health, but this does not appear to be true with modern diets. G. J. Parfitt, was, I believe, the first to point out that over 50% of the patients attending Guy's Hospital Dental Department for the treatment of acute gingivitis had an edge to edge bite or a cross bite. It would seem that in the absence of marked wear the edge to edge bite favours stagnation around the necks of the teeth.

Attrition in primitive man assured short clinical crowns to the teeth, and efficient self-cleansing of the gingival margins during mastication. With only slight attrition the edge to edge bite is a dirty bite.

TRAUMATIC OCCLUSION

Damage can be caused to the supporting structures of the teeth by overstress. Orban (1949) divides traumatic occlusion into two types: primary and secondary. Traumatic occlusion is primary if it affects teeth with healthy periodontal tissues, and is comparatively rare. It may be caused by high fillings or crowns, or by migration of teeth after extractions, or when only a few teeth remain to take the bite. Only very occasionally in a complete dentition does a malpositioned tooth suffer from primary traumatic occlusion.

Secondary traumatic occlusion occurs with teeth which have lost part of their

supporting structure. Periodontal diseases such as periodontitis, periodontosis or atrophy may have caused this loss of tissue, so reducing the supporting structures that normal functional stresses on the teeth may cause damage. Thus in treatment of advanced periodontal disease the reduction of stresses on the teeth, through spreading the load by splinting or balancing the occlusion by grinding or other methods, may be of great importance. But such mutilation of the dentition when the supporting structures are sound, as a preventive measure against future periodontal disease, is completely unjustified and may actually hasten the onset of the disease by increasing the stagnation around the teeth.

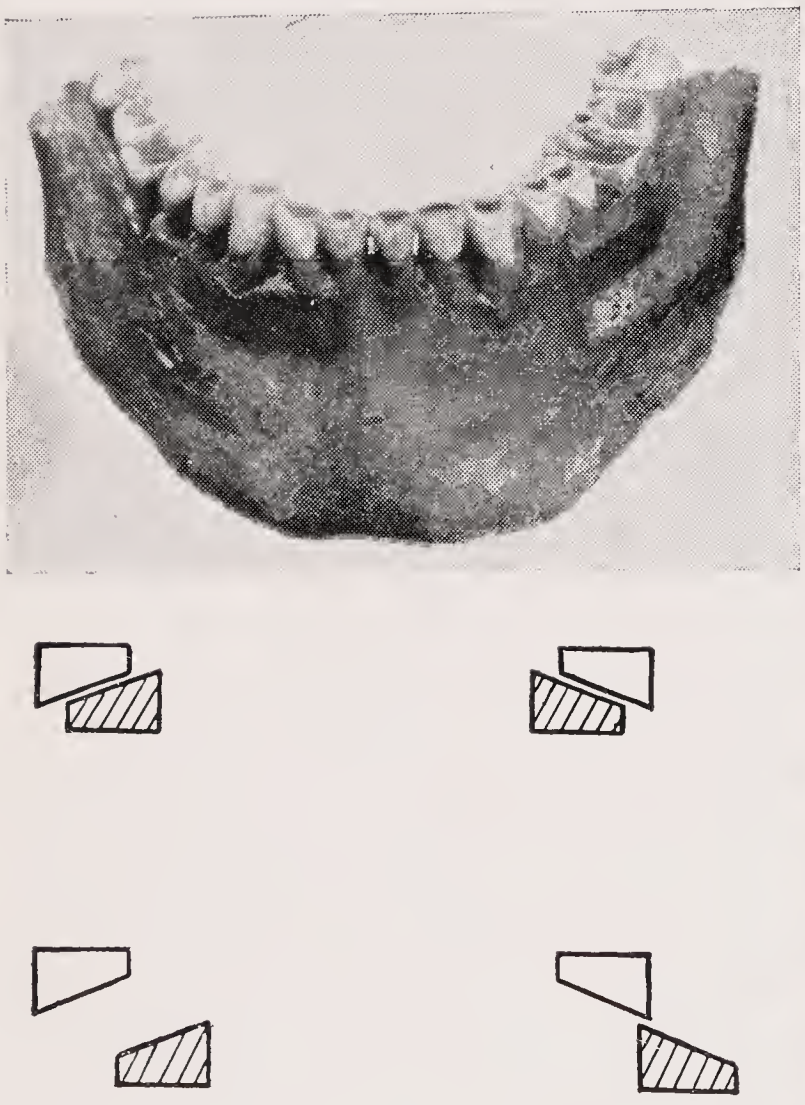

FIGURE 5

Photograph of part of an old English mandible showing considerable attrition of the teeth. The greatest wear has occurred on the buccal side of the occlusal surfaces of the cheek teeth, and the diagram of a frontal section through the cheek teeth of both jaws demonstrates that no balance is possible on lateral excursions of the mandible with this degree of attrition.

ANGLES CLASS II, DIVISION 2

Close bites of the Angle class II division 2 type are probably not such unsatisfactory dentitions as has often been suggested. They usually provide a most efficient shearing action. As a student I can remember being told that persons with this type of bite seldom retained their teeth after age 40. Probably some of you here tonight will agree from personal experience that this view was unduly pessimistic. The main danger with this dentition is when the tips of the lower incisors bite behind the cingula of the uppers, and cause direct trauma to the palate. The tips of the upper incisors may similarly traumatise the labial gingiva of the lowers. Periodontal abscesses are then liable to occur, the result of infected material being forced into the periodontal tissues.

THE OUTSTANDING TOOTH

Teeth which are outstanding, particularly in the lower arch, sometimes show a marked loss of gingival tissues, producing a vertical cleft on the labial or buccal side. This " asymmetric recession of the marginal line " was said by Stillman (1937) to be pathognomic of traumatic occlusion. It is, however, often difficult to demonstrate clinically how the tooth is traumatised, when it is in a contained arch

FIGURE 6

Male aged 34. Recession of the gingiva on the labial side of $\overline{1}$*, with considerable inflammation.*

FIGURE 7

Female aged 27. Recession on labial side of $\overline{1|}$ *with little evidence of inflammation. The X-rays show a normal width of periodontal membrane around* $\overline{1|}$.

and at a lower level than the teeth on either side (*Fig.* 6). Nor, in many cases is it easy to find radiographical evidence that bone has been lost from the mesial, distal or lingual aspects, or that the periodontal membrane is thickened (*Fig.* 7). In some cases the tooth involved may be completely out of occlusion in all positions of the mandible (*Fig.* 8).

Two other factors are probably far more important than traumatic occlusion in the aetiology of this gingival condition. Firstly, owing to its position, the outstanding tooth has, on eruption, only a thin layer of gingival tissues on its labial aspect. A marked discrepancy between the size of the dental arch and the size of the apical base will accentuate this, and alveolar bone may be deficient on the labial side. The thin tissues are unable to react adequately to a mild irritant, such as stagnation or tartar, and local atrophy results. Secondly, once the gingival margin has receded below the general level, further stagnation is favoured since this region is usually missed by the toothbrush, and may indeed be extremely difficult to keep clean from the interference of a labial fraenum. Invariably tartar is found in the depth of these gingival clefts.

FOOD PACKING MECHANISMS

Tilting of teeth following extractions in the same arch may produce a food packing mechanism. This is a common cause of severe localised periodontal disease. Such conditions frequently develop following the extraction of first permanent molars, which permits tilting of the second molars forming food packing mechanisms between the second and third molars (*Fig.* 9). Biting pressure during mastication causes the second molars to tilt further, opening up the contacts, and food is forced between the teeth. Elimination of this food packing is not a simple matter and may require the fitting of interlocking inlays, fixed bridges, or further extraction. Removal of the first permanent molars for caries control or any other reason is not favoured by the periodontist.

THE IDEAL OCCLUSION

Perhaps we can now enumerate some of the features of the ideal occlusion for periodontal health:

1. The segments of the arches should function as efficient shears, with successive point contact of individual teeth in the working segments.
2. The efficiency of the bite, and the resistance to disease of the periodontal tissues are not increased by the presence of balancing contacts in different segments of the arches during closed

FIGURE 8

Female aged 18. Recession around $\overline{1}$| with considerable inflammation. In the lower photograph the incisors are edge to edge. The patient has an anterior open bite and is unable to touch any upper tooth with $\overline{1}$|

movements of the jaws.

3. In centric occlusion the incisors and canines should be in contact with a definite overbite.
4. The dental arches should be regular and not too large for the apical bases.
5. The dental arches should be complete, but if extractions within the arches are unavoidable the remaining teeth must not be permitted to tilt and form food packing mechanisms.

For the continued health of an organ

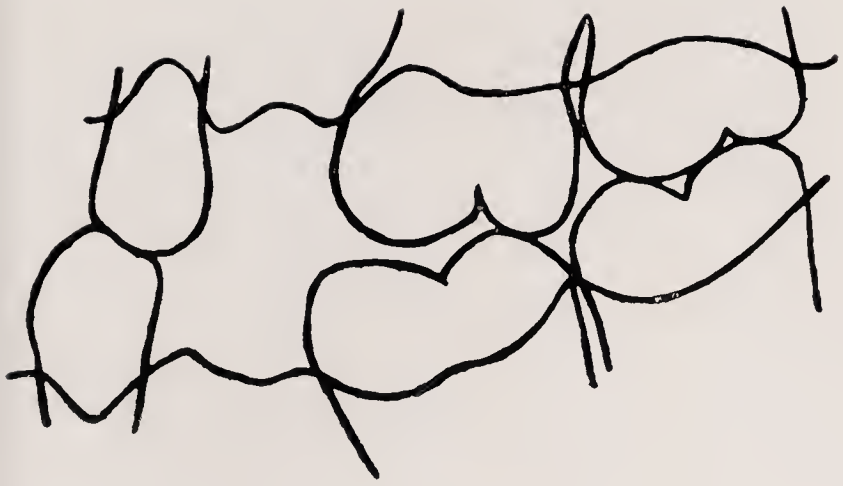

FIGURE 9

A drawing to show what may occur when the first molars have been lost. During mastication the second molars tilt further, permitting food to pack between the second and third molars.

there is an optimal stress to which it should be exposed. To reduce the normal stress on a sound dental organ to that which could be tolerated by a dental cripple, as a preventive measure, is unsound.

I should like to thank Mrs. M. E. Small of the Dental Photographic Department, Guy's Hospital, for the photographs.

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DISCUSSION

The PRESIDENT called on Mr. G. J. Parfitt to open the discussion.

Mr. PARFITT congratulated the author on his very ambitious title. It would be ambitious, he said, even before a group of periodontal people, and there would be a big argument as to how great the factor of occlusion was in the aetiology of periodontal disease. How great did the author consider this factor was and how did it work? He had mentioned traumatic occlusion and stagnation, but there were many other factors which produced periodontal disease.

The author was doubly ambitious in giving his paper before a group of orthodontists, because the orthodontist altered one of the factors, for better or for worse. He wanted to know what dangers he had to avoid and what dangers he was running into, so that he could weigh them up in discussion on prognosis.

He himself had been quoted as saying that in a group of patients who came to the hospital with gingivitis a number had a high dental height. One had been taught that the deep overbite was the cause of a great deal of periodontal trouble and from the age of forty was the cause of loss of teeth. Therefore the orthodontist was

commissioned to open bites and alter that deep overbite. He himself was interested in this matter and he found that the cases who came to the periodontal department were not those he was expecting but were types of high dental height, whether edge to edge or crossbite, or due to open bite or protruding teeth.

The author had given some examples of edge bites in ancient skulls, but this was quite a different matter because these teeth were worn down and they had not a high dental height at all but a very strong functional dentition. One would like to ask what type of occlusion resulted from the present diet. The author had summed up the various points—scissor action and so forth—but had he taken into consideration the actual diet and function? He was saying the function of the teeth must not be reduced, and he had criticised those who were practising bite rehabilitation by balancing the occlusion and spreading the forces of mastication over a large number of teeth. He (the author) had referred to the shearing action, and so on, of the animals and to the cutting efficiency at a particular point. But it would appear that with the modern diet function was minimal.

He was not sure that the present lack of function of the teeth was not one of the reasons for periodontal disease rather than the wrong type of occlusion. On this he would like to hear the views of the periodontists, including Mr. Emslie.

The author had talked about the spacing of remaining teeth when teeth were extracted. He himself had examined a school of two hundred and fifty children and for the purpose of opening the discussion had gone through the charts to see what effect the spacing of particular teeth had on periodontal tissue. When examining children for dental caries the spacing of the teeth and the periodontal condition had also been charted. It seemed that with spacing or an overlap there was a great deal more stagnation and with stagnation there was more inflammation of the tissues.

He would have liked to hear from Mr. Emslie of various surveys, or field work, on for instance, a number of types of occlusion, types of overbite, of edge to edge bite, post normal occlusion, mouth breathing, and their associated periodontal condition. He knew that Mr. Emslie had studied mouth breathers and he would have preferred to hear of this rather than about ideal occlusion.

The temporo-mandibular joint is always forgotten, but surely the occlusion between the mandible and the skull consists of the occlusal surfaces of the teeth together with the articulation of the condyle. In slightly inflammatory conditions of the gingivae consequent upon occlusion of the teeth surely the condyle path must be taken into account.

The PRESIDENT said that the author's description of the shear action of the teeth of various animals reminded him of the work of D. M. Shaw of the Royal Dental Hospital many years ago. He was almost a fanatic on that subject. Mr. Ainsworth was smiling so he knew all about that and perhaps he would like to enlighten the meeting.

Mr. AINSWORTH said that D. M. Shaw was rather a character. He remembered his teaching about jaws.

He agreed that one would have liked, in Mr. Emslie's stimulating paper, a little more backing for the conclusions that had been reached. He heartily agreed with those conclusions without the backing, but he had not the body of knowledge on the subject that he would like to have.

He had noticed that the deep recession of the gingiva over prominent teeth was very often associated with the absence of buccal bone. In many cases, the bone was deficient in patches right up to the apex of the canine. The same thing occurred with the palatal roots of molars which sometimes showed an enormous absorption of gum.

I believe that in these cases the palatal

side of the root is very thinly covered with palatal bone which may be atrophied early. A thin layer of gum not attached to bone was not able to withstand the wear and tear to which it was subjected.

Mr. BALLARD said that however much one might have disagreed with some of the things that Mr. Emslie had said, one ought to thank him for bringing before the Society a subject which was fundamental in orthodontic treatment planning as well as in periodontal disease. He himself agreed with Mr. Emslie in being a little sceptical about balanced occlusion, but the question of the axial inclination of the teeth to occlusal stresses had been worrying him for some years. At the present time this is most important because of the relationship of orthodontics for the masses to the problem of early loss of deciduous teeth and forward drift of the first permanent molars. With early loss not only did the lower molar tilt forward but it also moved bodily. This meant that the first permanent molar could not be uprighted to put it at its correct axial inclination to occlusal stresses, and at the same time find room to accommodate the canines and premolars. If a premolar then had to be extracted the space might close up, but it would do so by a further forward tilting of the first permanent molar. This forward tilting might not completely fill the space so that both axial inclination and relationship was anatomically unsound. That was liable to produce periodontal diseases in middle life. If this was a correct interpretation of what happened following extraction in the lower jaw, whether to relieve an inherited overcrowding or that resulting from early loss, then the orthodontist would be forced to undertake extensive measures to put cheek teeth into correct axial inclination and create contact relationship. The only reliable technique for this would be a multiband one. He supported Mr. Parfitt's idea of a field survey to show precisely what was produced in later life by abnormal axial inclination of this kind. The real damage occurred then. From such a survey there might emerge at least one substantial argument against people who said that the early loss of deciduous teeth, and even planned extraction of the first permanent molars resulted in no harm to the permanent dentition.

Someone in high authority had recently stated that early loss did not result in any harm to the permanent dentition. A field survey would show what should be produced in the way of functional occlusion in orthodontics as opposed to random extraction to produce some aesthetic result rather than a true function.

Mr. A. R. F. THOMPSON said that he agreed wholeheartedly with Mr. Emslie. One of the points which had been brought out more clearly, perhaps, than anything else was that the axial inclination of the teeth as they met each other, that was to say, the inclination of the upper teeth in relation to the lower teeth, was not a serious aetiological factor in the disease. Mr. Ballard had made the point that maybe the axial inclination did matter. He himself would suggest that a minor reason why this mattered was that it might admit of food packing, but it was not serious on its own account. He believed the lower incisor met the cingulum facets of the upper incisor at an angle of something like 90°, which was surely about as far as possible from axial contact. It did seem that this question of teeth meeting axially was of no moment whatever, and that the crux of the matter was whether the bone was strong enough or not to meet the existing force.

Most people would recognise the patient who was going to have periodontal disease in the very early teens. One could tell merely by a casual inspection of the gums if a patient was going to lose these teeth in the early twenties or at most thirties. The reason was that the structure was fundamentally inadequate. The actual relationship

of the teeth was of secondary importance.

Many things were done for periodontal disease. For example, teeth often had their occlusion tinkered with and were at the same time splinted together. He was convinced, as an ordinary practitioner, that far and away the most important factor was the splinting of the teeth together. He had had a particular case which illustrated this, he thought, to a nicety. He did an apicectomy on an upper lateral tooth. At the end of six months no bone had formed round the end of the tooth in the bone cavity and the tooth was slightly loose. It was then joined to the next tooth, by some conservative dentistry, and in another three months the bone structure had completely regenerated very satisfactorily. Only one thing had been done: the tooth had been stabilised. The occlusion was not altered. Personally, he felt that stabilisation was the important factor and that attempts to alter axial inclination were valueless.

Mr. Cross (Visitor) said that he was in the opposite camp. He believed that the balancing of the occlusion was a most important factor not only in the treatment of established periodontal disease but also in its prevention.

There were many ways in which balanced occlusion could be carried out. Incidentally he did not think it was in any way necessary, in considering a balanced occlusion, to imply balance of the so-called balancing side, as in the case of the full dentures. But one of the most important ways of achieving a balanced occlusion—in other words, a freely sliding articulation where as many teeth as possible on the working side were in contact, similarly in the protrusive relationship—was by the process described as long as thirty-five years ago by Stillman—selective grinding. This procedure was relatively straightforward to carry out. It followed well established rules and it was very far from mutilating the dentition. In fact, it very often did exactly the reverse. In many patients where upper incisors—and perhaps lower incisors too—were loose, the teeth which most often had to be ground were those long and often unsightly upper incisors. Grinding the tips of these incisors, the incisal edges, so as to achieve a balance in the protrusive field of at least the upper incisors and preferably the upper canines as well as an even contact in protrusion, very much improved the patient from the aesthetic point of view, in most cases.

He agreed with Mr. Thompson that splinting was an important measure in stabilising a dentition. It must be, of course, but it was of no avail unless carried out in conjunction with adequate equilibration—balancing the occlusion.

Mr. Ballard said he agreed with Mr. Allan Thompson that when, from the orthodontic point of view he saw lower buccal segments in particular with their axial inclination disturbed it might be that in fact it was the contact points permitting food packing which was the main cause of the periodontal condition. Perhaps what he visualised as a functional lower arch, was one which was splinted through contact points. The occlusal stresses in the buccal segments were taken with the teeth in slight mesial axial inclination. If the mesial contact points were not firm then this mesial axial inclination would permit a slight tilting movement on occlusion. In talking about the arch as being functionally sound, he was really meaning not only from the point of axial inclination of occlusion stresses, but also in contact point relationships.

Mr. Wilson said that he had no doubt in his own mind that malocclusion and traumatic bites were a factor in producing periodontal condition. On the other hand, he would emphasise that they were only factors. He had seen quite a number of gross malocclusions where the gingivial condition was healthy in the extreme. At the same time, he had been called in by periodontal people to treat malocclusions and to assist in treating the periodontal

condition, for which he must take some credit. By treating these malocclusions he had assisted in the treatment of the periodontal condition. This was working more or less from the other end—from the clinical and pathological end as opposed to the ideal from which Mr. Emslie worked.

There were many other factors, some of which might be inherited; and there were the factors of local and general lowered resistance: when to these was added the additional factor of malocclusion, a periodontal condition could appear.

Mr. E. K. BREAKSPEAR said that Mr. Emslie had answered a query which had been in his mind for four or five years. He had shown a case to the Society three or four years ago where the periodontal condition of a particular mouth, which had had some orthodontic treatment was not good. One particular tooth had resisted alignment, and at the end of the treatment it was exactly the same as at the beginning. It was about as abnormal as could be imagined for that particular tooth. Yet in spite of the generally poor condition of the periodontal tissues it was as healthy as could be expected and definitely better than many of the others, whether they had been treated or not.

It was a lower third molar which had tilted lingually so that the upper third molar bit on the buccal surface, and the stresses must have been at right angles to the normal stresses. Compared with the other teeth in the mouth it was remarkably healthy periodontally and he could not understand why. He had asked at the time whether anyone had any explanation to offer in view of the very bad traumatic occlusion but none had been forthcoming. Mr. Emslie had provided an answer. If one looked at it from the stagnation angle, the lingual surface of the tooth was in much closer contact with the tongue than was normal and that would mean that it would have more cleansing on the lingual side. But because the buccal surface was lying more or less horizontally, it would have more self-cleansing from mastication. If in this case the stagnation factor were the deciding one, it fitted in with what Mr. Emslie had said.

Mr. WATKIN said that he joined forces with the speaker who had said that there were a lot of other factors to be taken into account. With the extraction of the first permanent molar one must be quite certain the diagnosis is correct or the 2nd molar may tilt forward, causing food packing. When there was crowding the space closed entirely and one had 2nd and 3rd molars absolutely vertical and there was no packing at all.

Mr. K. PRINGLE asked what should be one's aim with these lower incisors that were outstanding and stripped, if it was not to move them out of traumatic occlusion.

The PRESIDENT said he did not want to take the answer out of Mr. Emslie's mouth with regard to splinting, but it must be borne in mind that the cure was probably rest. To splint the normal teeth would, he imagined, do harm rather than good, because it would reduce the work they should do by relieving them of stresses and strains essential to health.

The problem seemed to be very largely one of which occurred first—the orthodontic or the periodontal, or both together. Undoubtedly many of the population had good periodontal conditions and one could not alter them. Others had poor conditions and one could only ameliorate those. However, he did not want to depress anyone but rather to encourage research to find the cause and cure.

Mr. EMSLIE said in reply to Mr. Parfitt that periodontal diseases were mainly inflammatory, and that the inflammation was caused by an irritant. An irritant in the mouth was always a local irritant, and was chiefly the toxic products of food stagnation. Tartar was also liable to form in stagnation areas. However, stagnation was increased or decreased by many factors, such as lip-seal, the type of

mouth, the type of tongue, the lazy mouth, and so on. The shape of the arch was another factor. All these factors, and others, affected the degree of inflammation. There might be no inflammation clinically, but whenever one took a biopsy specimen, even from a healthy mouth, there were some inflammatory cells in the gingivae if teeth were present. In edentulous areas there was no evidence of inflammation. When teeth were present there was always some irritation to the gingival tissue. The inflammatory reaction was greatly affected by the tissue resistance, and certain conditions—hormone imbalance, pregnancy and deficiency states, were examples—altered the reaction of the tissues. But it was always a local irritant in the mouth which initiated the inflammatory reaction.

The first question was whether, with a sound dentition to begin with, overstress on the teeth was a sufficient irritant to cause gingivitis. He himself did not see how gingivitis could be brought about by overstress on the teeth. It could be, and often was the result of direct trauma on the gum. The second question was whether, with a full complement of teeth, there was enough overstress on the teeth in normal mouths to cause continual damage in the periodontal tissue and result in a downgrowth of the epithelial attachment and the formation of a pocket.

When, as a result of disease, a large amount of supporting bone had gone, the reduction of stress on the teeth was an important part of treatment. That had been brought out in the discussion, and he agreed wholeheartedly. But when one started off with sound tissues, such treatment was entirely unnecessary. Occasionally one might have, say, an outstanding lower incisor that was completely outside the bite, and in any lateral movement of the mandible that tooth might take the whole of the lateral stress. Such a tooth might suffer from primary traumatic occlusion, but it was an extremely rare finding.

It had been suggested that lack of function produced periodontal disease. Lack of function caused a thinning of the periodontal membrane, a thinning of the trabeculae of the bone, and thickening of the cementum. Then the tooth could not withstand much in the way of sudden stress. If it were put back into function temporarily, it would be painful because the periodontal membrane had lost most of its principal fibres. Lack of function would not produce gingival inflammation unless stagnation was thereby increased. It usually was, but if the patient were told that the functionless tooth should be kept absolutely clean with a toothbrush, the periodontal tissues should remain free of disease. Therefore he could not see that lack of function or reduced function was responsible for the prevalence of periodontal disease today, except through the effect of increased stagnation.

A big survey had been suggested, but so many factors were involved that it was impossible—or almost impossible—to equate these cases. One could use the P.M.A. indices of one region of the mouth. The upper incisor region had been used in one survey but the gum condition in this region was affected very much by lip-seal. Lack of lip-seal in young children was probably one of the most important factors in the aetiology of their gingivitis. Then some had anterior open bite, close bite, and so on. Every case was individual and could not be fitted into a large-scale study. Almost every case that was examined would have to go into a separate category. It would not be easy, as in dental caries studies, where one could pick out six or seven holes here and there and produce reliable statistics. He would be very happy indeed if anyone could suggest a method of making such a study of periodontal diseases but it would be extremely difficult to work out.

He could only agree with Mr. Ainsworth. Loss of tissue particularly on the palatal

side, would appear to be caused by a similar mechanism, but how could one differentiate—in running a survey—between cases suffering from trauma and cases suffering from food packing? Again, no two investigators would agree as to whether the amount of inflammation of the gingival margins was due to food packing in a particular case or to overstress because the axial inclination was wrong, or was not the hypothetical norm.

He agreed with Mr. Thompson about the angle at which the teeth met. There were plenty of other animals whose teeth met at much worse angles as far as axial inclination was concerned. Take the pig's lower incisors. Presumably if they were inclined they had supporting tissues which would maintain them at that angle.

Splinting in advanced periodontal disease was an excellent form of treatment.

He had expected considerable disagreement from Mr. Cross. He agreed with reduction of stress when the teeth were loose and the bone had been lost, but he had been trying to point out throughout the evening that if one did this as a preventive measure, one would lose a certain amount of the efficiency of the bite. One might also increase stagnation, particularly if one was opening or building up the bite, or doing full bite rehabilitation—certainly if one was going to put on a lot of gold appliances, and crowns. Before anyone did this as a preventive measure, they should endeavour to make sure that every other preventive measure for periodontal disease, such as oral hygiene and thorough scaling and polishing, had been thoroughly investigated first. He felt sure that the general use of so-called bite rehabilitation as a preventive measure would do more harm than good.

He agreed with Mr. Wilson that traumatic occlusion was a factor, particularly in the advanced case. But very seldom was it a primary factor. It did occur, but only rarely. The malpositioned tooth, as Mr. Breakspear had pointed out, could stand up to an amazing amount of stress in most cases. It would stand up to continual overstress provided it was within a certain limit; but one knew that if a tooth were overstressed, one got death of tissue in the periodontal membrane. With intermittent stress one got resorption of the bone and widening of the periodontal space. If the space could be widened sufficiently and still contain adequate periodontal fibres to maintain the teeth functionally, that would not cause any downgrowth of epithelium.

Great force on a tooth could cause necrosis in the periodontal membrane. The first sign of traumatic occlusion was looseness of the tooth. If acute damage had been caused, it would also be sensitive on percussion. The patient would try to avoid using it to allow the tissues to recover. Primary traumatic occlusion was a rare condition.

In reply to Mr. Watkins, he said that biting function was not necessary for healthy teeth if the teeth were kept absolutely clean.

Mr. Breakspear had referred to keratinisation of the gum. A well-known periodontist in this country had pointed out that keratinisation of the gum through friction was a most important protection against periodontal disease. When the teeth were extracted the gums did not require friction to keep them healthy. Why should they require it when the teeth were present? Friction, particularly when applied with a wood point, was an excellent method of cleaning the teeth and the crevices between the teeth and the gums. He imagined that the important action of the wood points was that they were cleansing the teeth and the crevices.

The answer to what should be done with the outstanding tooth—apart from orthodontic treatment about which he would not attempt to talk here—was first class hygiene. The patient should be taught how to clean his teeth and get right down to the bottom of the crevice so that no tartar was

permitted to form there. The condition should then not progress, but the epithelium would not re-attach to the tooth. This epithelium exposed in the gingival sulcus was being desquamated and could not re-attach to cementum or dentine which had an infected surface. But if first-class hygiene was persisted with the condition would not progress, although one might in a few cases have to remove the labial fraenum to permit the patient to maintain good hygiene.

That was probably the answer to the President's last question. It could not cure itself. With young children continued eruption of the teeth might make it appear to be cured, but the epithelium would not re-attach to the denuded root of the tooth.

The President said that the discussion had been very interesting. It was now his duty to invite the meeting to pass a very hearty vote of thanks to both authors for their efforts to entertain and instruct.

A Modification for the Sved Bite Plate

by J. S. Beresford, b.d.s., h.d.d.

If an orthodontic appliance could be appraised by an index representing a combination of the two factors, its effectiveness and the simplicity of its construction, then a high value would be given to the bite plate described by Sved in 1944. Details of construction and methods of use of the Sved bite plate are found in the literature. Figure 1 illustrates the reduction in depth of overbite obtained by a co-operative patient in seven months with this appliance.

In a proportion of cases after the vertical overbite has been reduced there remains a space in the horizontal plane between the tips of the lower incisors and the palatal surface of the upper incisors. This overjet is equal to the thickness of clear acrylic resin which covers the palatal aspect of the upper incisors as shown in figure 2. The difficulty may be over come by casting in silver or " white gold " a section of the plate covering the tips and palatal surfaces of the incisors (and canines if erupted) and

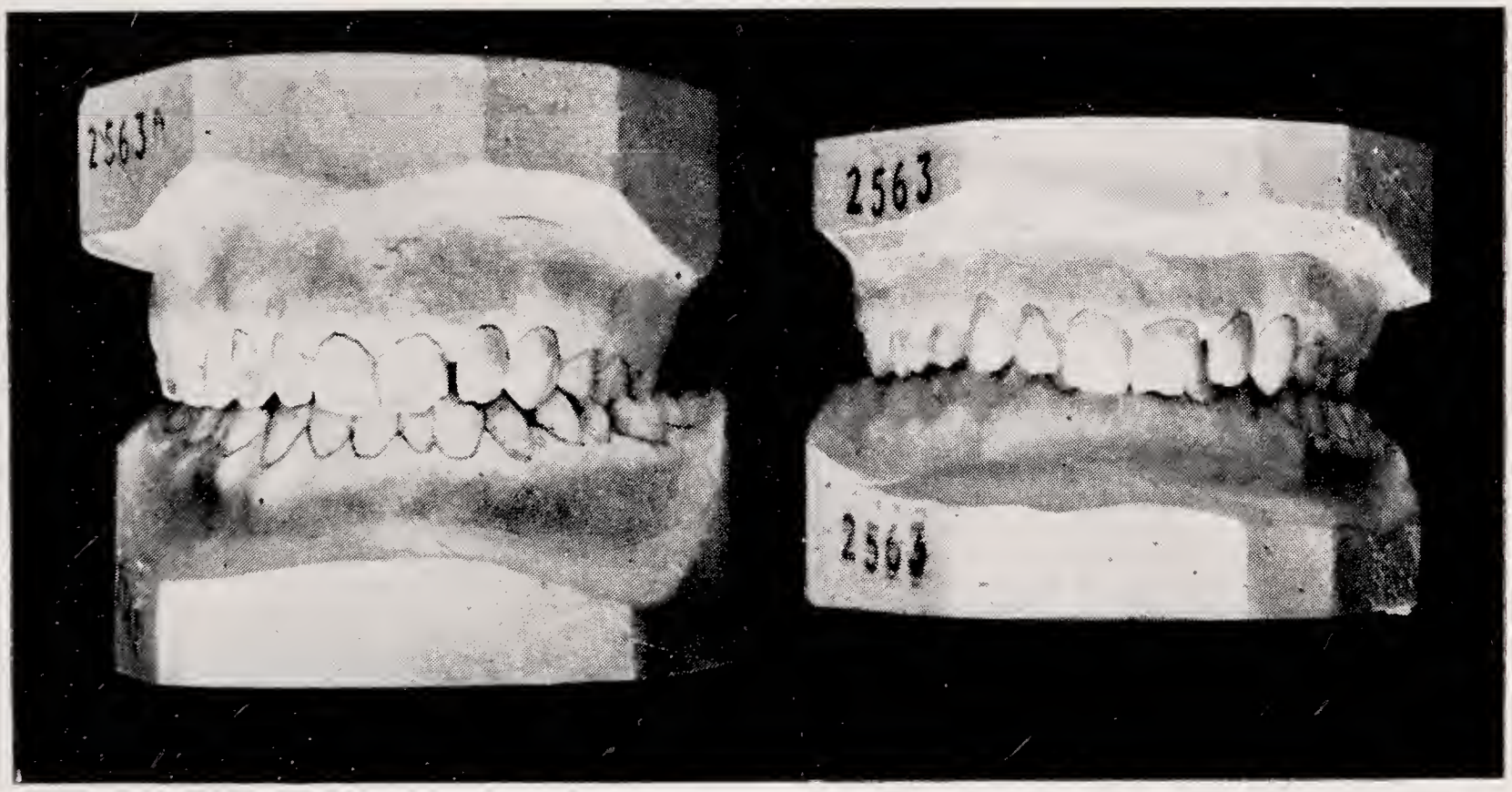

Figure 1.
Models of Case before (on right) and after seven months treatment with a Sved bite plate.

Short communication presented to the meeting on 10*th March.*

Figure 2.

Diagrammatic section showing (above) a case of deep overbite (centre) the case with a Sved bite plate in site (below) the effect of modifying the plate by incorporating a metal section.

extending far enough on to the palate to be retained in the acrylic resin.

The lower diagram in figure 2 is a section of such a plate. The biting platform itself is of acrylic resin and acrylic carried around the distal of the lateral incisors (or canines) is continuous with the acrylic resin on the labial aspect. Figure 3 illustrates a palatal view of the finished plate.

Figure 3.

A palate view of a Sved bite plate with a metal inset.

Figure 4.

Intra-oral view of the plate in situ.

In preparing the metal section the pattern in 6 or 8 gauge wax is withdrawn from and the casting made off the model as is usual with cap splints. The polished casting is returned to the model and the plate is waxed up for processing. A narrow bridge of stone hard plaster, extending from one side of the model to the other and reinforced with stainless steel wire, is run across the area of exposed metal palatal to the incisors prior to flasking. This holds the metal section in position when the wax is boiled out of the flask.

In figure 4 the plate in the mouth is illustrated.

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DISCUSSION

The PRESIDENT said that Mr. Beresford had made a very practical communication.

Mr. RICHARDS said he was interested to note in Mr. Beresford's plates that the angle of the inclined plane was an extremely steep one. He had not used Sved plates personally, but he had insisted on having this extremely steep angle on bite plates he had used, and by and large there had been no difficulty in opening bites.

In the past, he had wondered what was the practical significance of taking the incisal edge part of the plate into consideration at all, because if one had steep anterior incline, the bite seemed to open quite well.

The PRESIDENT asked whether the metal clip to which Mr. Beresford had referred would not be satisfactory.

Mr. Herbert C. Visick had such a plate in which a half-round wire came from the palatal aspect, down the lingual surfaces and engaging the incisal edges to bring back as well as depress the upper incisors. This reminded him to ask Mr. Beresford what tooth movements occurred.

With regard to the steep angle, he wondered whether, in some cases, to ensure the molar coming even more forward or to act even better, it could not be made still more steep, so that the mandible could not slide back the small amount it appeared to do.

Mr. SOFTLEY asked Mr. Beresford if he had trouble with decalcification of teeth beneath Sved plates. In Liverpool there have been a number of such cases following the use of these plates, and because of this they have been discarded in favour of Visick plates.

Mr. GARDINER asked how well Mr. Beresford's patients tolerated Sved plates. Theirs, he said, did not tolerate them either because of the visible portion on the labial aspect of the upper incisors or because of the difficulty in masticating.

Mr. BERESFORD, in reply to Mr. Richards, said that he had not realised that the inclined plane was so steep until he had made a section of the plate. It did not look so steep until he cut it in half.

The metal clip acted in precisely the same way as the plain acrylic Sved bite plate but was thinner on the palatal surface. It did not have the springiness. He did not think it contributed to the tooth movement any more than the acrylic did. He did not know what teeth moved or where they moved, but if he found out he would inform the President.

Sved used the plate for two purposes—to open bites and to retain teeth which previously were rotated. He did not use this appliance to align them. The ordinary retainer sometimes allowed incisors which had been rotated to relapse a little, but the Sved plate gripped the incisal edges very firmly and rotation was prevented. As a retainer the plate was only worn part of the time and to open the bite it was worn all the time.

So far he had not had decalcification but he should watch for it and thanked Mr. Softley for the warning. He instructed his patients to wear the plate at all times, except for meals initially, and then to eat something each day for practice, say some biscuits and then to wear it at all meals. This was the first plate he had used covering the occlusal or incisal surfaces. Mr. Endicott used to warn him strongly against decalcification and he would heed the warning.

In reply to Mr. Gardiner, he said that he had been surprised how well patients tolerated the plate, but perhaps he had been lucky in his patients. The clear acrylic was not very noticeable, and it was difficult to tell when the patient came in whether the plate was being worn or not. If there was silver, he explained to the patient that it should be brushed a good deal to keep it shining, and the fact that it was shining when it was given to the patient seemed to intrigue him and add to his interest.

A Museum Demonstration

W. J. Tulley, F.D.S.

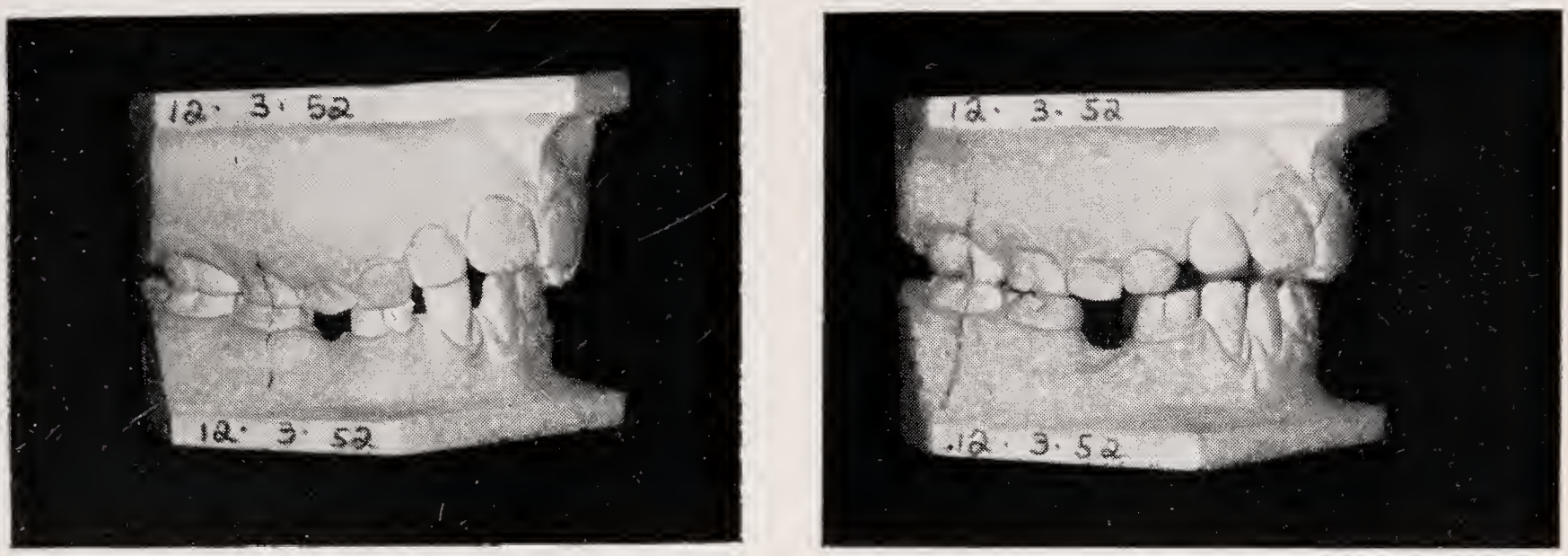

FIGURE 1.
Models of uniovular twins with geminated c.b. and thumb sucking habits. One had stopped sucking the thumb three months before the other. Presented by Mr. K. E. Pringle.

The aim of this demonstration was to present a cross section of museum material to encourage members to send new material.

Models were shown in the following groups:

1. Serial studies of occlusion.
   (a) Models from birth to seven years presented by Dr. Sillman.
   (b) Serial models from 9 days to 3.6 years. Postnormal mandible at birth. Improved at 3.6 years.
   (c) 5 pairs of models. Presented by Miss Clinch.
2. Unusual pathological conditions related to orthodontics. This included:
   (a) Multiple supernumeraries.
   (b) "Submerged" and unerupted deciduous molars.
   (c) Grossly displaced teeth and teeth of abnormal form.
3. Serial models of cases treated by extraction. Presented by Mr. R. E. Rix and Mr. K. E. Pringle.

A demonstration at the meeting on 12th May.

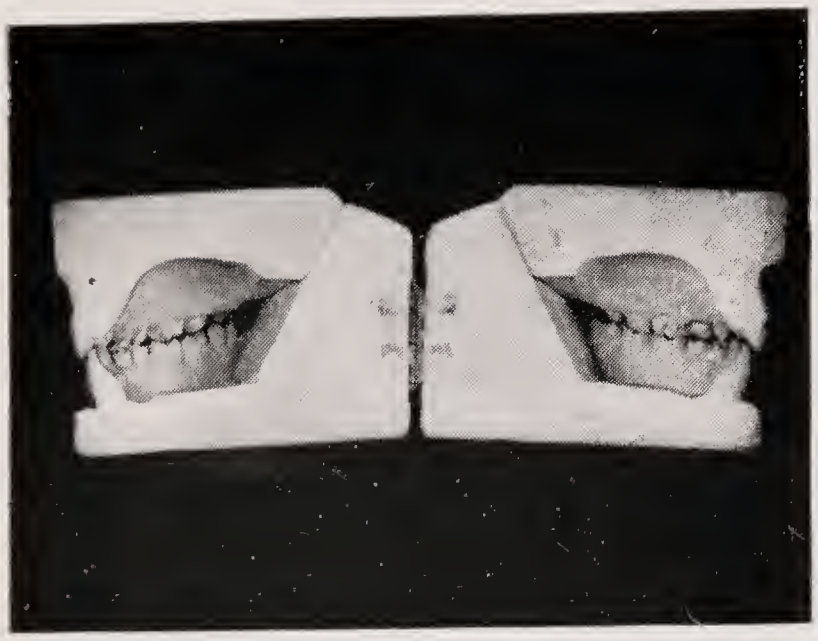

FIGURE 2.

Hinged technique model 1898 presented by Mr. E. C. Dimock.

4. Models of identical and fraternal twins with special reference to sucking habits.

5. Historical appliances.

A carved ivory plate with pegs (date unknown).
Presented by Professor Friel.
A Technique model (1898).
Presented by Mr. A. C. Dimock.

A Friction Fit Attachment

W. Trevor Johnson, L.D.S., R.C.S. Eng.

A Friction Fit Attachment of a thinner wire to the thicker wire of the framework of an orthodontic appliance may be in the form of a hook for an elastic with a loop and stop as used on a labial arch, a simple stop, or an arm. The method of attachment has advantages over a weld in being movable medially or distally along the arch wire and less likely to fracture at the point of attachment; but when thicker wires are used for the attachment it is more bulky.

Fig. 1 is a drawing to illustrate three short lengths of 1.00 mm. wire with one of each of these attachments on them. It will be noted that the length of arch wire is in each case, very slightly (and smoothly) tapered at one end. The four turns of the thin wire are preformed on a wire of lesser diameter than that of the arch wire and then forced on to it. In the actual construction of an appliance, the attachments are added to the arch wire before any bends are made in it. They can be added later, however, by reducing the diameter of the arch wire by stoning it near the site of attachment, making the four turns on this narrower part, and then forcing it along.

" A " is a simple stop, to limit the range of action of a spring, as used in Figs. 2, 3 and 4 below. 0.30 mm. wire is used.

" B " is a drawing of the distal part of the right side of a labial arch as used for inter-maxillary traction. It will be noted that for the hook two right and two left hand turns are used to lessen the risk of rotation. Both these attachments do sometimes rotate buccally, but this causes little inconvenience and the

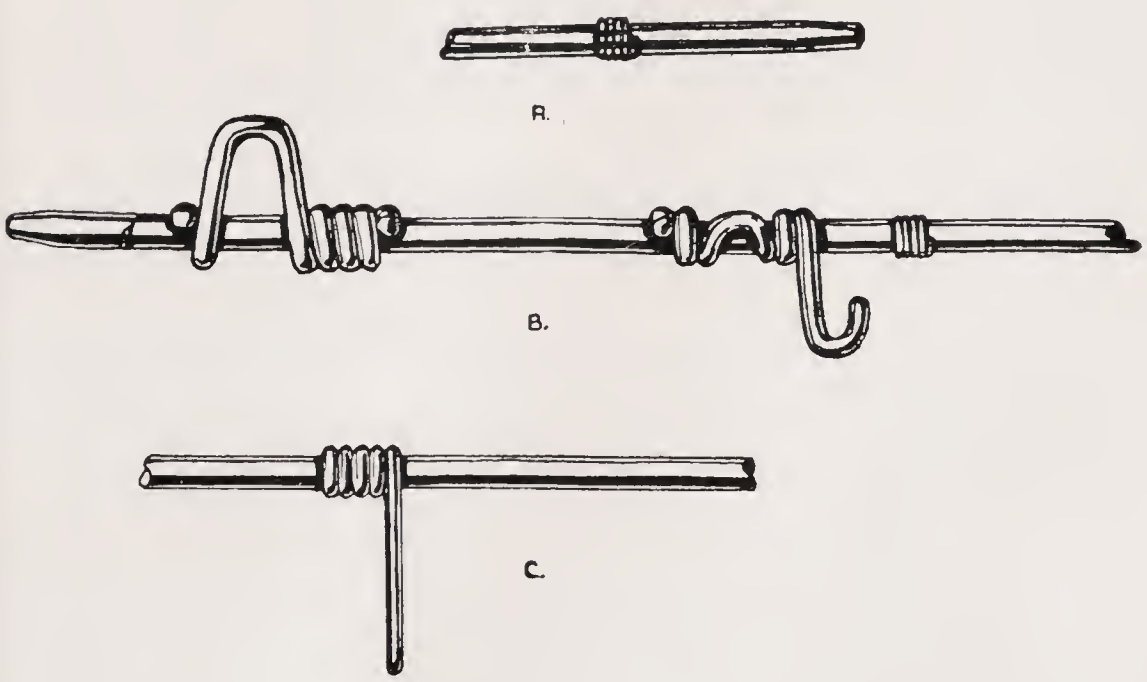

FIGURE 1.

A demonstration at the meeting held on 12th May.

patient can be shown how to push them back with, say, a wooden clothes peg. The hook can be made longer than can be risked with a weld and, at the same time, provide a more horizontal pull of the elastic. The wire for the hook is 0.60 mm. and for the loop and stop 0.50 mm. The purpose of the loop is to facilitate the tying in of the arch when this is required.

" C " is an arm used in Figs. 2, 3 and 4 below. 0.30 mm. wire is used. Two right-hand and two left-hand turns are sometimes used to provide greater rigidity.

Fig. 2 is to illustrate a Friction

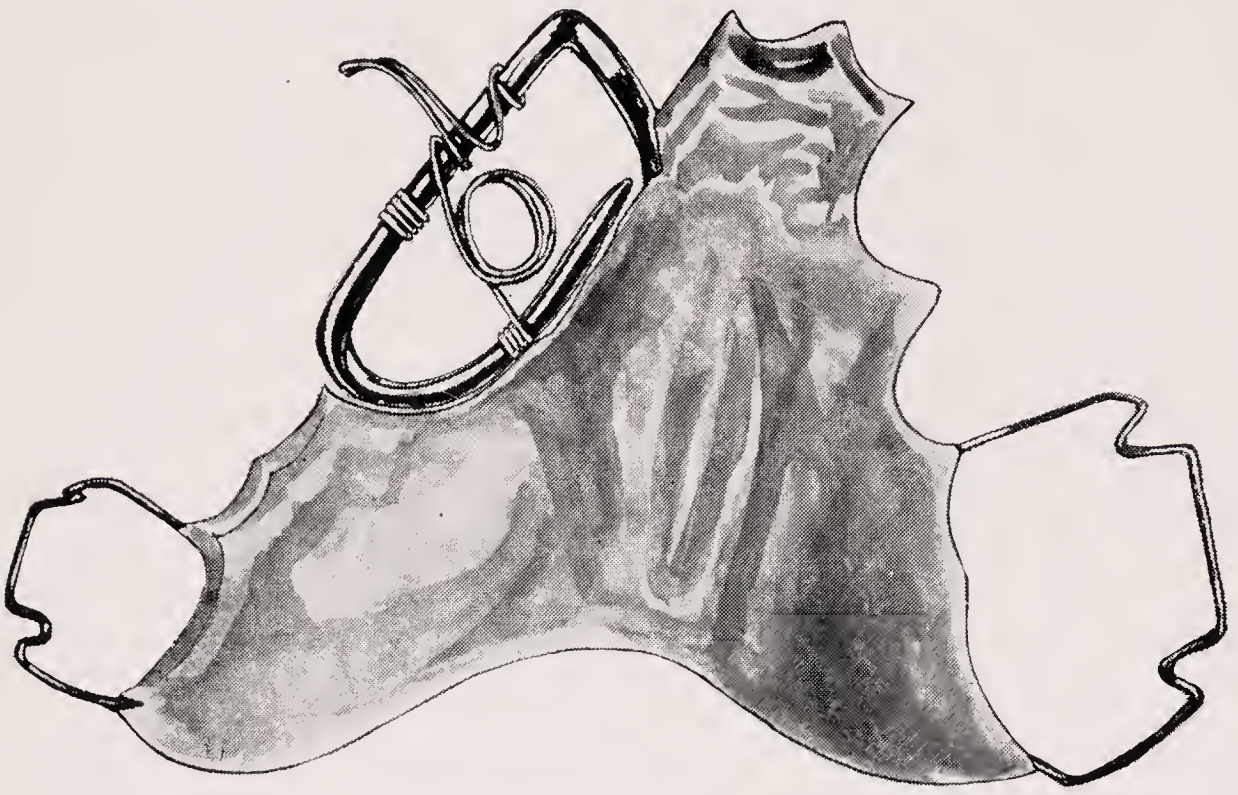

FIGURE 2.

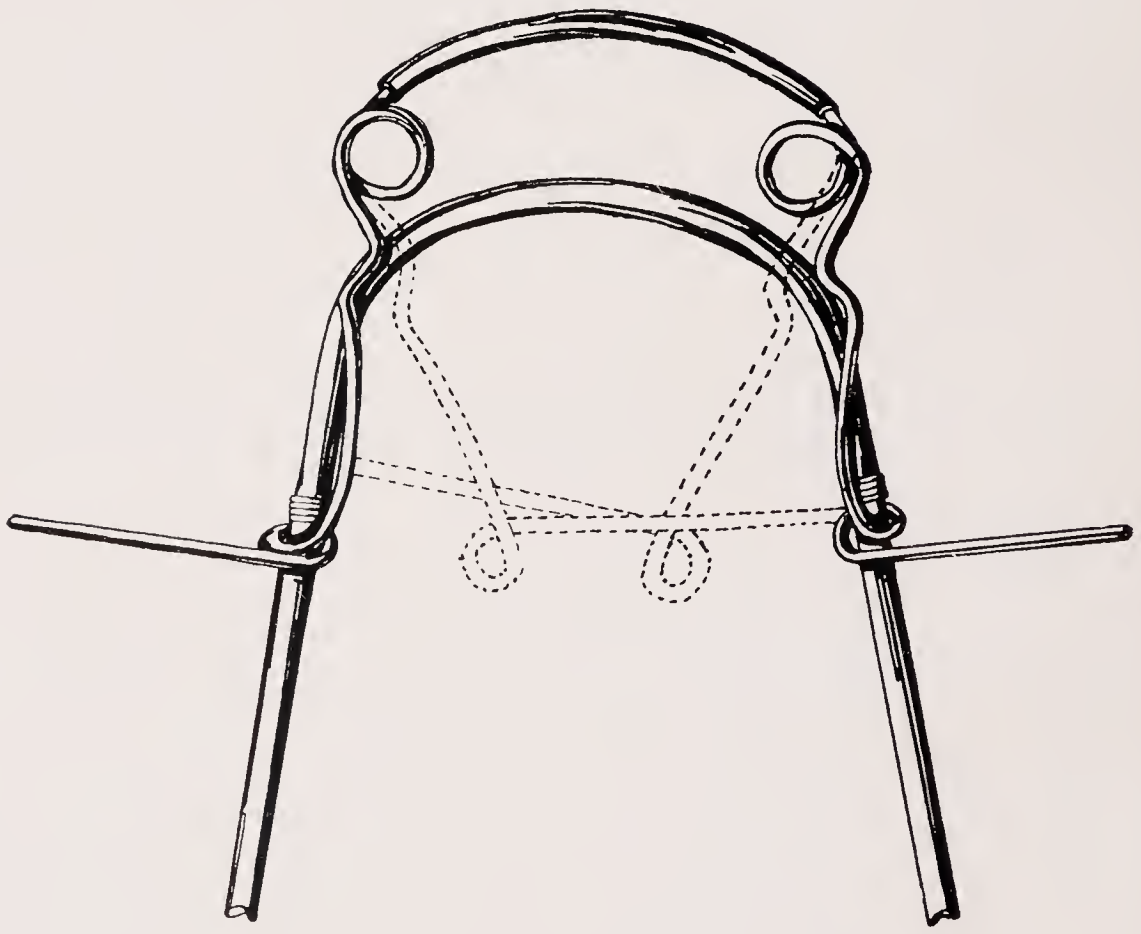

FIGURE 3.

Fit spring which can be used on a fixed or removable appliance from the buccal or lingual side to move teeth medially or distally in the line of the arch. It will be noted that two parallel or nearly parallel thicker wire arms form part of the framework. The spring has a long range of action and a stop can be used, as illustrated, to limit the distance the teeth can move, which is very desirable in some circumstances. 0.30 mm. wire is used and the trigger, when used from the buccal side, is very short and easy to control and will force its way between two teeth in firm contact. In the plate shewn, the spring is designed to move a canine distally.

Some practice is necessary to obtain the correct degree of tightness. With types " A " and " B " using 0.30 mm. wire on 1.00 mm. the coils are preformed very firmly on 0.90 mm. wire and movement medially or distally is easily effected with light pressure. With " C " a more rigid attachment is required and is obtained by winding not quite so tightly on 0.80 mm. wire. In type " A " the wires are thicker and the coils should be still very firmly preformed on 0.90 mm. wire, as the maximum rigidity is called for. To move these, two pairs of grooved pliers are sometimes necessary. As a general rule it can be taken that the thinner the wire of the attachment, the tighter the preformed coils must be made.

It is quite likely that a 0.35 mm. wire wound very tightly on to an edgewise arch will hold a ligature as efficiently as a loop or soldered attachment and have the advantage of being movable, but this has not been tried on an appliance yet.

Three Types of a Lower Appliance to Regain Space in the Mandible.

The first two appliances are used when the loss of space in the cheek teeth areas is bilateral and the amount lost is approximately equal on the two sides.

In Fig. 3 the appliance is viewed from the gingival aspect and in Fig. 4 from the occlusal. In both, only the anterior portion of the lingual arch is shewn, the distal parts carrying the anchor bands and tubes and posts being omitted. The propelling force to move the anterior sliding unit forward is produced by pressure of the two arms of the slider on the 1.00 mm. wire of the framework which converges as it runs forward from the molars. This method of propulsion was demonstrated by De Coster in 1939 but his application of it is different. The general purpose of the appliances is to upright the molars and move the teeth anterior to the spaces medially by the amount they have migrated.

The type illustrated in Fig. 3 is indicated when $\overline{E}/\overline{E}$ have been lost and $\overline{D}/\overline{D}$ or $\overline{4}/\overline{4}$ are in position. The slider has a long range of action, and as the molars are uprighted, it tends to engage the incisors too near to the incisal edges. To prevent it from slipping over the tips, two stops are necessary to limit the range of action, and these are best forced on to the framework wire before it is shaped to the model. The wire of the sliding unit is of 0.50 mm.

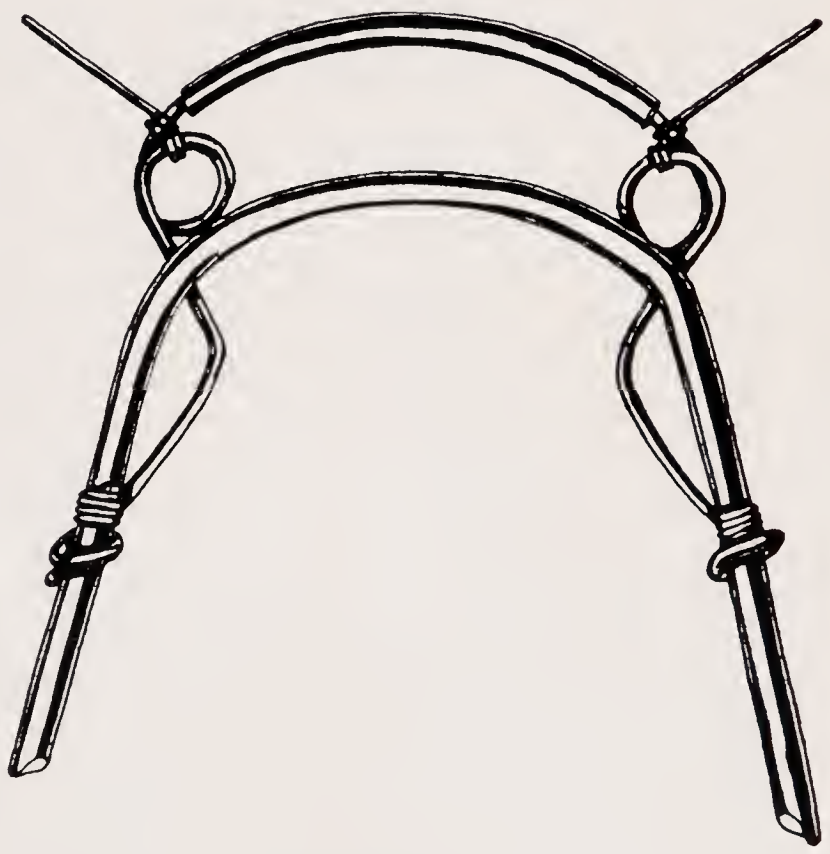

FIGURE 4.

diameter, and to reinforce it in the anterior part, a length of end-tubing, as used in twin wire arch technique, is slipped over it and the unit completed as shewn. The position of the spring when activated is marked in dotted outline. The distal rings of the 0.50 mm. wire are partly preformed on a length of 1.20 mm. diameter wire, leaving the circle incomplete with an opening wide enough to pass them over the 1.00 mm. wire of the framework. The rings are then completed round the 1.0 mm. arch itself. The stops in this appliance need only be tight enough to " stay put " and they can then be moved forward to increase the tension of the spring without removing the appliance.

Fig. 4 is a variation of the above, and shews a way of attaching arms to engage $\overline{2}|\overline{2}$ or $\overline{C}|\overline{C}$ or $\overline{3}|\overline{3}$ when the deciduous teeth distal to them are lost. The two arms are of 0.30 mm. wire and are attached by two double turns of the spring wire at right-angles in the manner described by Rix in 1938. These are best added before the sliding unit is attached to the framework by taking the first two turns of the wire round the 0.50 mm. wire, at a convenient point, passing it forward through the two rings and then completing the other two turns just distal to the ends of the end-tubing.

Fig. 5 shews the appliance designed for loss on the right side only but in general it is used to regain space when the loss is on one side only, or to regain space on one side when the loss is greater on this side than the other. It may be used before or after the appliances shewn in Fig. 3 and 4 its purpose being to make the spaces on the two sides approximately equal.

The attachments to the molars are, on the left by a round vertical tube preformed

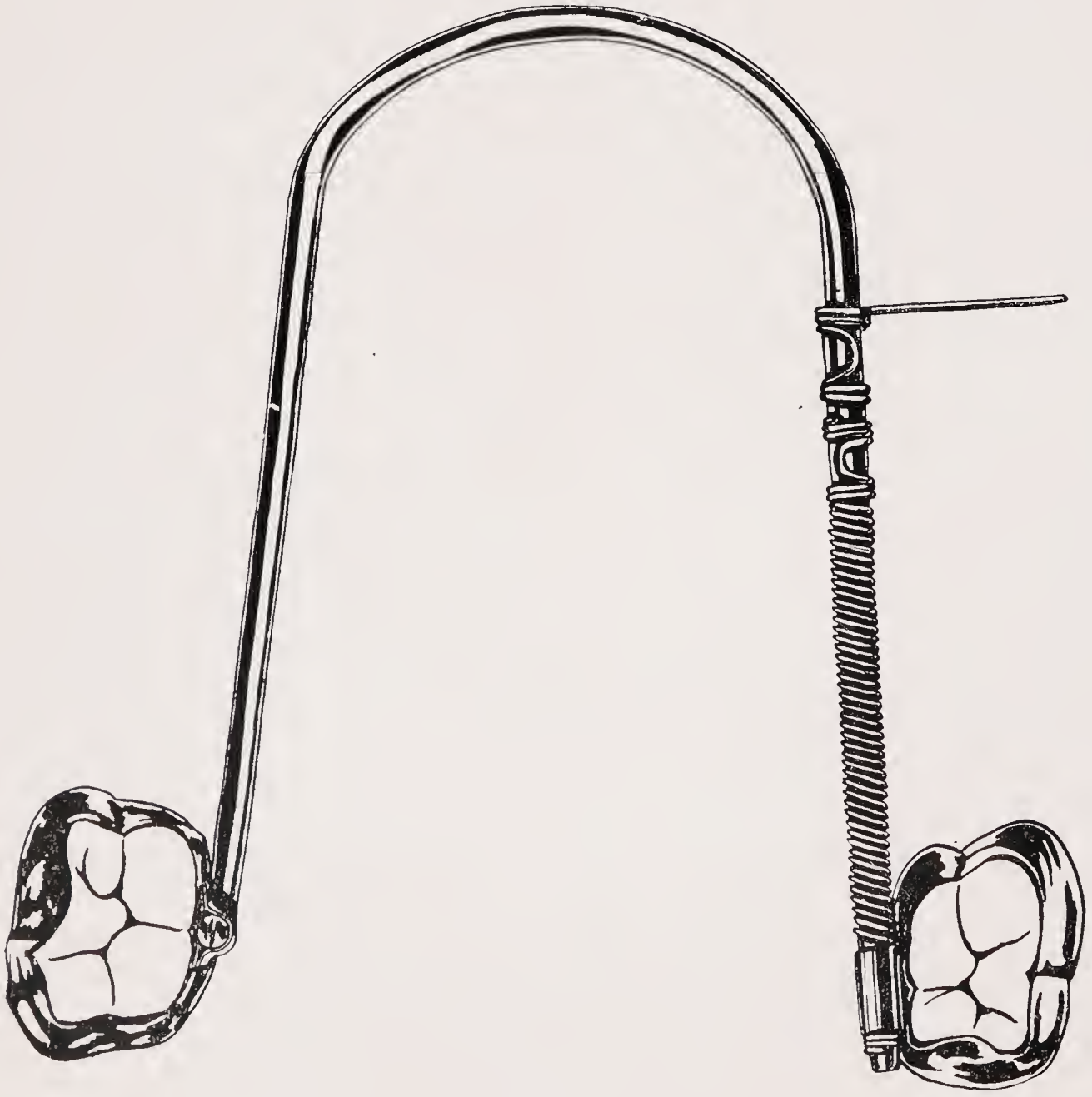

FIGURE 5.

on 0.90 mm. wire, and on the right a round horizontal tube preformed on 1.00 mm. wire, as devised by Selmer-Olsen. The arch is of 0.90 mm. wire. The vertical tube on the left is locked by a stop weld (Friel) and a stop is used distally to limit the range of action of the spring and prevent the arch from moving forward out of the tube. The arm to engage the tooth medial to the space is of 0.35 mm. wire and the stop to activate the spring, 0.30 mm. The coil spring is of 0.20 mm. wire. The last two auxiliaries are added before the 0.90 mm. of the framework is fitted to the model.

I am indebted to Mr. A. J. N. Swann, B.S.S., for the drawings.

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Misfits

By Rachel Sclare, lds, u. leeds

Models for some misfits with which the orthodontist is confronted were shown. They included the following conditions:—

(a) Discrepancies in arch sizes.

1. Cases in which the maxillary arches were larger than the mandibular arches, with all the maxillary teeth in buccal occlusion with those in the mandible, so that the palatal surfaces of the upper premolars and molars were in contact with the buccal surfaces of the corresponding lower teeth.
2. Cases in which the maxillary arches were smaller than the mandibular arches. The teeth in the upper jaws were crowded and in lingual occlusion with the teeth in the mandible.

(b) Discrepancies in the size of the teeth.

1. Small teeth in large arches resulting in interstitial spacing especially in the incisor region.
2. Large teeth in small arches causing gross irregularities due to overcrowding.

(c) Discrepancies in the number of teeth.

1. Excessive number of teeth. Models showed the presence of supernumerary teeth ranging in number from 1 to 3 in the incisor region.
2. Deficient number of teeth. A case of partial anodontia with only $\frac{6EC/C\ \ E6}{6EC/CDE6}$ present was shown.

(d) Transposition of teeth.

One case showed a bilateral transposition of canines and first premolars.

(e) Social Misfit.

Gross malocclusion due to persistent thumbsucking.

A demonstration at the meeting held on 12th May

Some Routine School Cases

By Miss E. M. Webster, ddo, lds

In this demonstration several cases were shown which had been treated by simple appliances and good results obtained.

Two cases have been selected for illustration.

CASE I

R.W. Male, aged $9\frac{1}{2}$ years.
Class I. Postural prenormal.
Treatment:—
Duration—4 months.
Appliances—(1) Upper Friel plate.
(2) Upper expansion plate with springs I and I.

FIGURE 1A

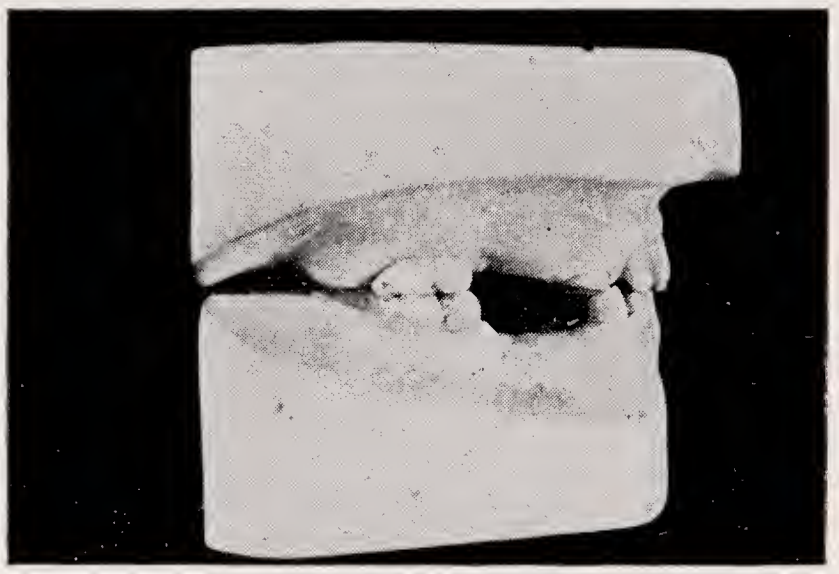

FIGURE 1B

CASE II

A simple spring which can be used to create space as in Fig. 2A.

FIGURE 2A

Fig. 2B close-up of spring in action. This spring can also be used to approximate two teeth as in spaced central incisors.

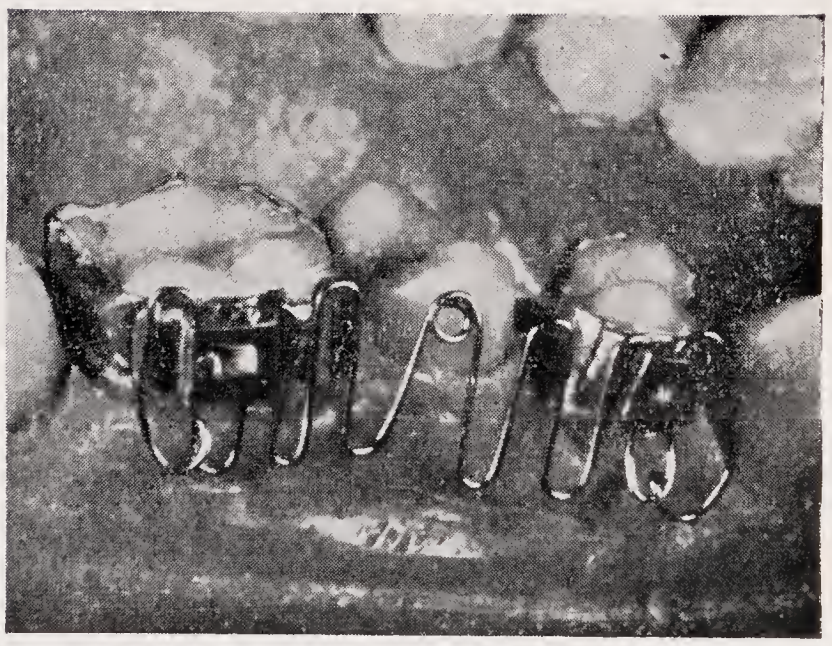

FIGURE 2B

A demonstration at the meeting held on 12th May.

Attachments for the Twin Wire Arch in Stainless Steel

D. F. GLASS, DDO, RFPS, LDS, RCS.

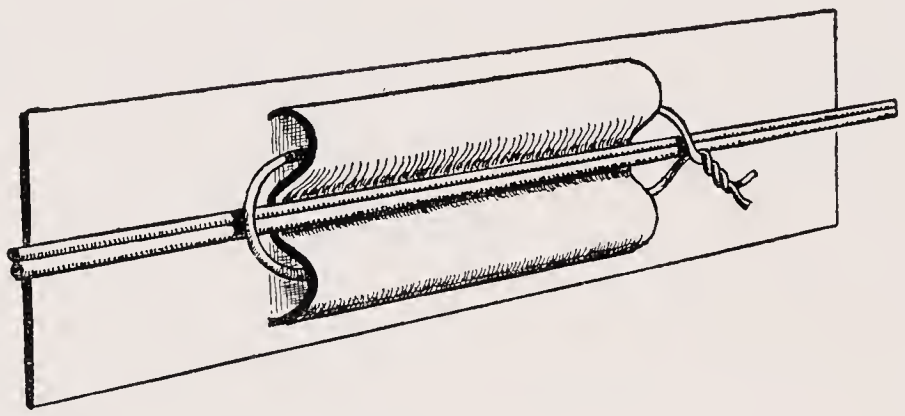

FIGURE 1.

THERE ARE three main types of attachment for a twin arch to the anterior teeth:

(1) The "W" LOCK with soft wire ligatures.
(2) The SPIRAL LOCK.
(3) The SLIDING SLEEVE attachment.

(1) "W" LOCK. Commonly used in England. The "W" for the lock is made from stainless steel tape being pressed with special "W" forming pliers. These locks are welded to the band forms before the bands are constructed, or can be welded to the finished band before cementing. The twin wire is secured to the "W" lock by a ligature of soft stainless steel wire, 2 mm., passing through the "W" and tightened by twisting, and then bent and pressed into the inter dental space to prevent rubbing. (*Fig.* 1).

Advantages

(a) Simple to make, and easy to weld "W" lock band.

Disadvantages

(a) Needs special "W" forming pliers.
(b) Changing of arch involves much chairside time as ligatures have to be removed and retied with the new arch.
(c) Ends cause trouble by becoming dislodged and cutting soft tissues.
(d) Precision of tooth movement not well defined.
(e) Over rotation not possible.

A demonstration at the meeting held on 12th May.

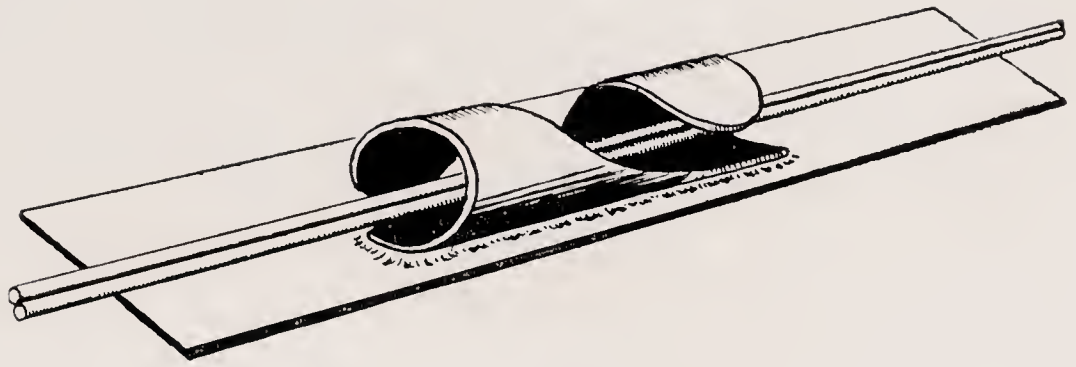

FIGURE 2.

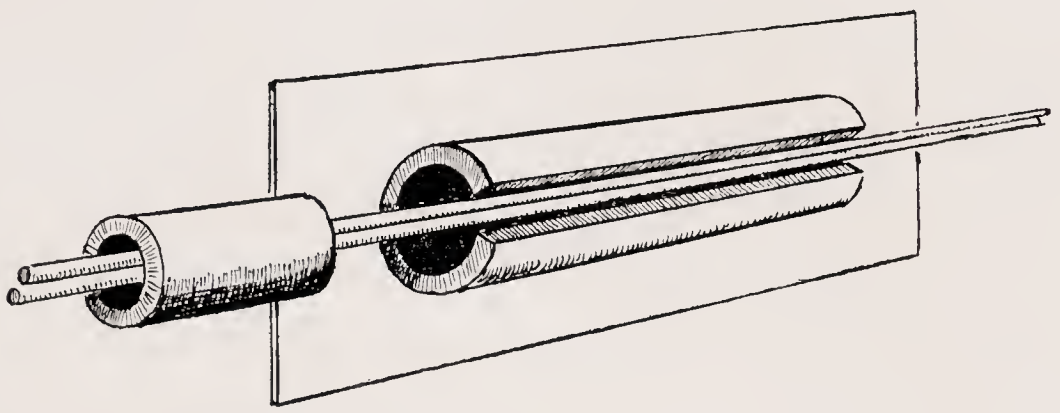

FIGURE 3.

(2) THE SPIRAL LOCK. The main feature of this attachment is a short length of stainless steel tubing, 9 mm. or other suitable diameter, which is fixed to the anterior band at right angles to the long axis of the tooth, either by welding alone, or welding followed by soldering. The .9mm. tube is then cut with a carborundum disc to form a spiral opening along its length, just wide enough to admit the twin wire arch. To secure the arch, the twin wires are sprung through the spiral opening into the tube, where they remain secure. (*Fig.* 2).

Advantages

(a) Simplicity of securing the twin wire arch.
(b) Very simple to renew the twin wire arch.
(c) Great saving in chairside time.

Disadvantages

(a) Technician's work increased, fixing the tubes to the bands and cutting the spirals.

(3) SLIDING SLEEVE. This is a most efficient and accurate mode of attachment. Construction is as for the spiral lock but the .9mm. tube opening to admit the twin wire is cut straight across at right angles to the long axis of the tooth (*Fig.* 3). The construction of the twin wire arch is altered to include short lengths of .5mm. stainless steel or other suitable tubing. To fit the arch the twin wires are passed through the cuts in the labial tubes and anchored by sliding the .5mm. tubes along the arch into position. These small sliding sleeves may be further secured by flattening one end to give a wedging effect for the final fixation.

Advantages

(a) Easy to secure twin wire arch.
(b) Easy to change twin wire arch.
(c) Great precision.
(d) Over rotation of tooth possible.
(e) Great saving of chairside time.

Disadvantages.

(a) Technician's time increased as for making of spiral lock.

Various combinations of the Spiral lock and the Sliding Sleeve (*Figs.* 2 *and* 3) may be used and modifications in detail devised to suit individual cases:

(1) In the case of one rotated incisor, all anterior bands carry a spiral lock except the one on the rotated

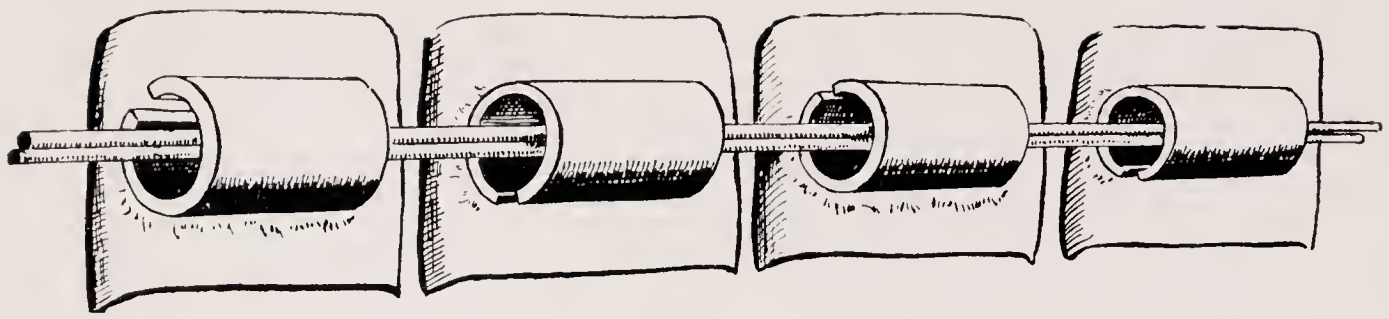

FIGURE 4.

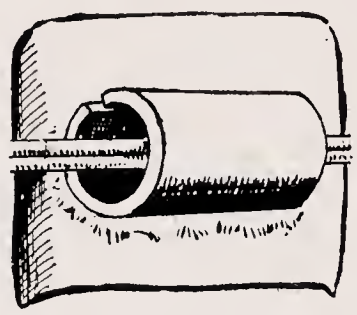

FIGURE 5.

tooth. This carries a sliding sleeve to give greater precision of movement. The twin wire arch in this case is constructed to carry only one .5mm. sliding sleeve.

(2) Another modification of the sliding sleeve attachment can be made by cutting the buccal tubes horizontally as for *Fig.* 3 but alternately on the gingival and the incisal surface of the .9mm. tube as in *Fig.* 4. The twin wire arch is sprung into the .9mm. tubes. The inclusion of a sliding sleeve on the twin wire arch gives added accuracy.

In rotating teeth it is often beneficial to over rotate in order to compensate for relapse. This can be done most efficiently with the sliding sleeve attachment, the .9mm. tubes being fixed to the bands at the correct angle to over rotate the teeth.

In cases of unerupted or instanding teeth, the band tube can be cut to form a hook to retain the twin wire arch, and the sliding sleeve omitted until the tooth reaches more normal alignment (*Fig.* 5).

Some Observations Upon the Environment of the Incisors

R. Ernest Rix, fds, mrcs.

I want to deal with some aspects of the immediate muscular environment of the front of the dental arches and to show that certain trends in incisor position and relationship are associated with particular changes in the environment.

During mastication one sees a balanced play of activity between the lips and cheeks on the outside of the arches and of the tongue lying within. Without this interplay, food could not be guided and held precisely in position while the teeth shear and crush it. The teeth and alveolar bone are promontories jutting out into this sea of muscular activity and they too are subjected to the same guiding forces which control the food. The position of food is the result of momentary muscular activity. The position of our less mercurial teeth reflects, within certain limits, the result of a summation of external and internal muscular activity over a period of years of growth.

Mastication provides stresses upon the dento-alveolar structures which serve to keep the radial positions (i.e. bucco-lingual and labio-lingual) of upper and lower teeth closely related. Since the combined width of all the upper teeth is slightly greater than the width of all the lowers it is to be expected that the upper teeth shall be arranged on a slightly larger perimeter, producing the usual external upper incisor overlap and external overlap of the buccal cusps of the upper cheek teeth.

While mastication provides peak periods of stress calculated to foster well knit radial relations another muscular stress, that of swallowing, is being exerted intermittently, and, of course, continues to be exerted at other than mealtimes as well. For better or for worse swallowing adds its contribution to the moulding forces created by mastication.

By the time the permanent dentition starts to arrive the teeth are normally brought into occlusion during the act of swallowing. With the teeth in occlusion a rigid walled cavity is produced. The external musculature is comparatively inactive while the tongue, with the aid of the mylohyoids, exerts its thrust in the form of a peristaltic wave against the walls of the cavity to force food back through the isthmus of the fauces. (Professor Whillis demonstrated this movement of the tongue by direct ciné photography to this Society in 1946 and more recently Ardran and Kemp have used X-ray ciné films). A beneficial centrifugal thrust to the dento-alveolar structures is provided in this way which is not counterbalanced by external musculature in a state of considerable tension, and there is no element introduced to upset the good radial relations of the teeth which mastication fosters.

Paper presented to the meeting on 13th October.

For reasons of space, some illustrations have been omitted.

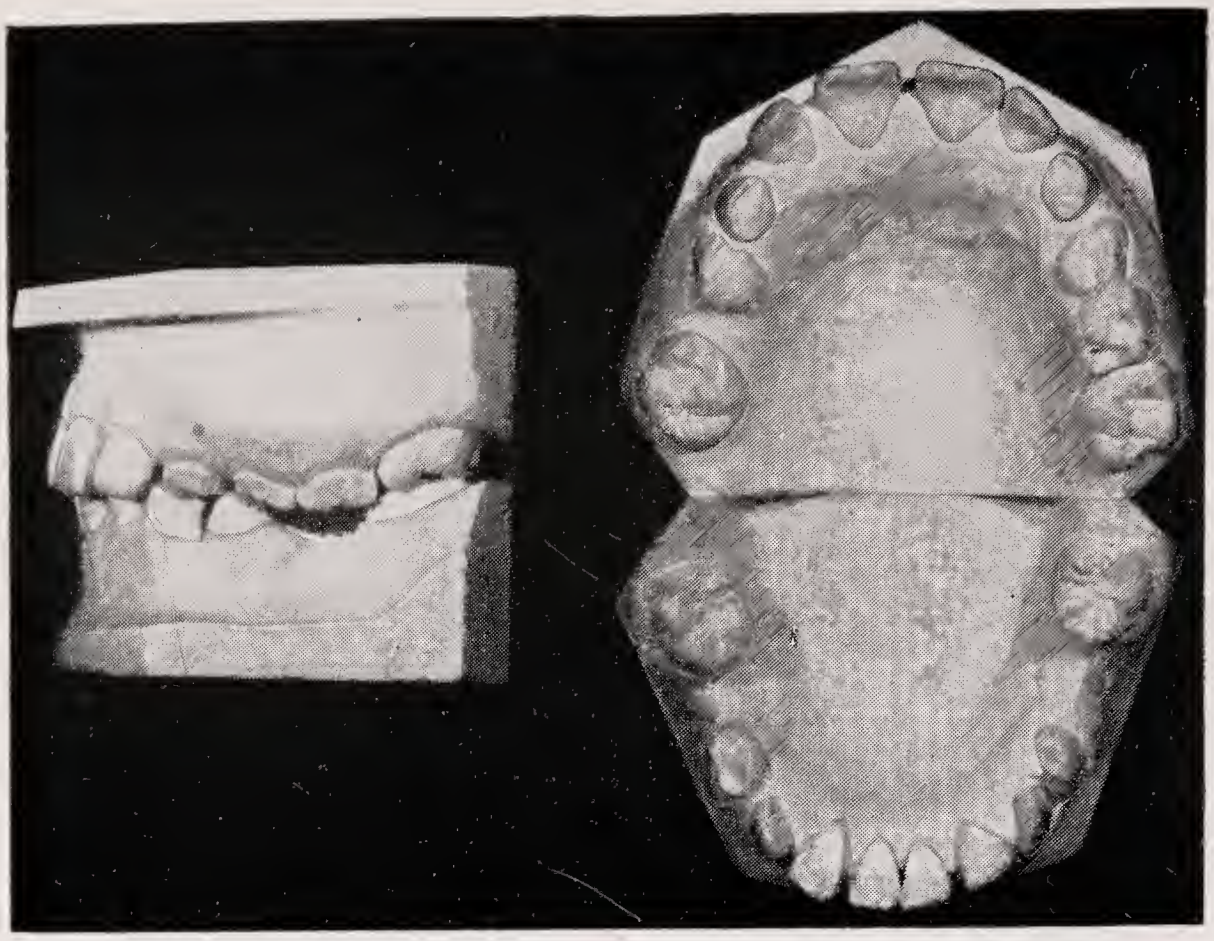

FIGURE 1.

Normal behaviour during swallowing. Despite early loss of lower deciduous molars a good incisor relationship is maintained.

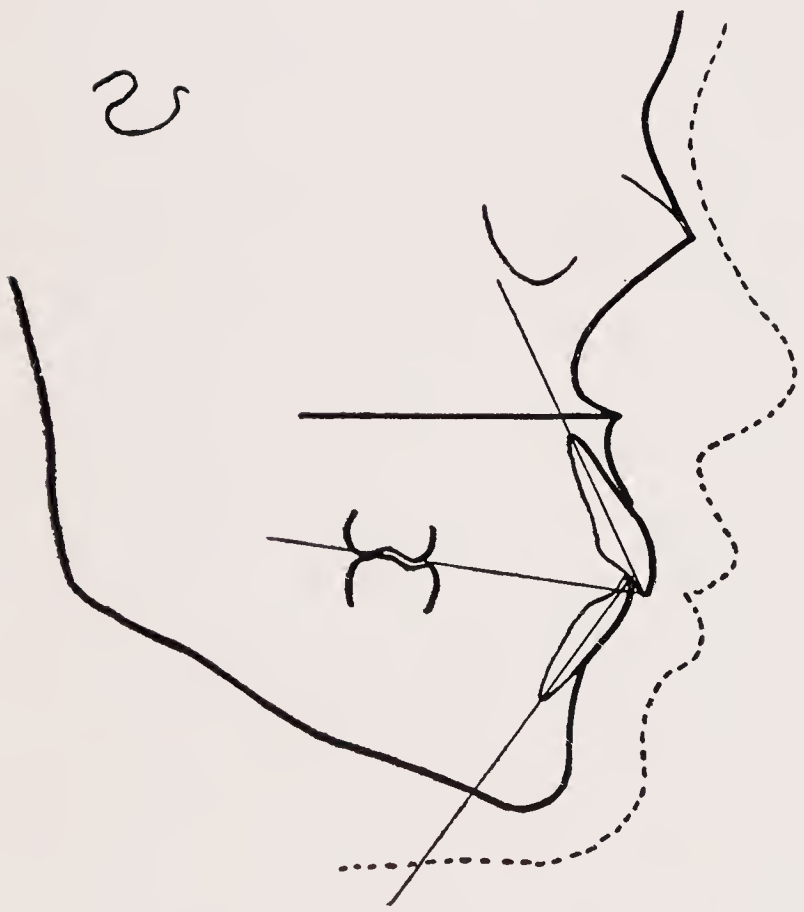

FIGURE 2.

Profile X-ray tracing of case in Figure II

Figures 1 and 2 show a dentition developing in this satisfactory environment. Despite early loss of deciduous molars good radial relations of the incisors are being maintained.

In a good muscular environment it is usually difficult, however, to maintain good alignment, as opposed to relationship, of the crowns of the six upper anterior teeth unless the cuspal relations of the cheek teeth are normal. If the cuspal relations tend towards a Class II relationship, upper alignment suffers. Six upper anterior teeth can ordinarily be arranged in good alignment around the perimeter of the lower arch in the region of the eight lower anterior teeth, the upper canines lapping over the mesial half of the lower first premolars. More than six upper teeth cannot be arranged in good alignment around the same lower perimeter. Incisor relationship does not primarily depend on the correct interdigitation of the cusps of cheek teeth. It is upper alignment which is dependent upon correct interdigitation.

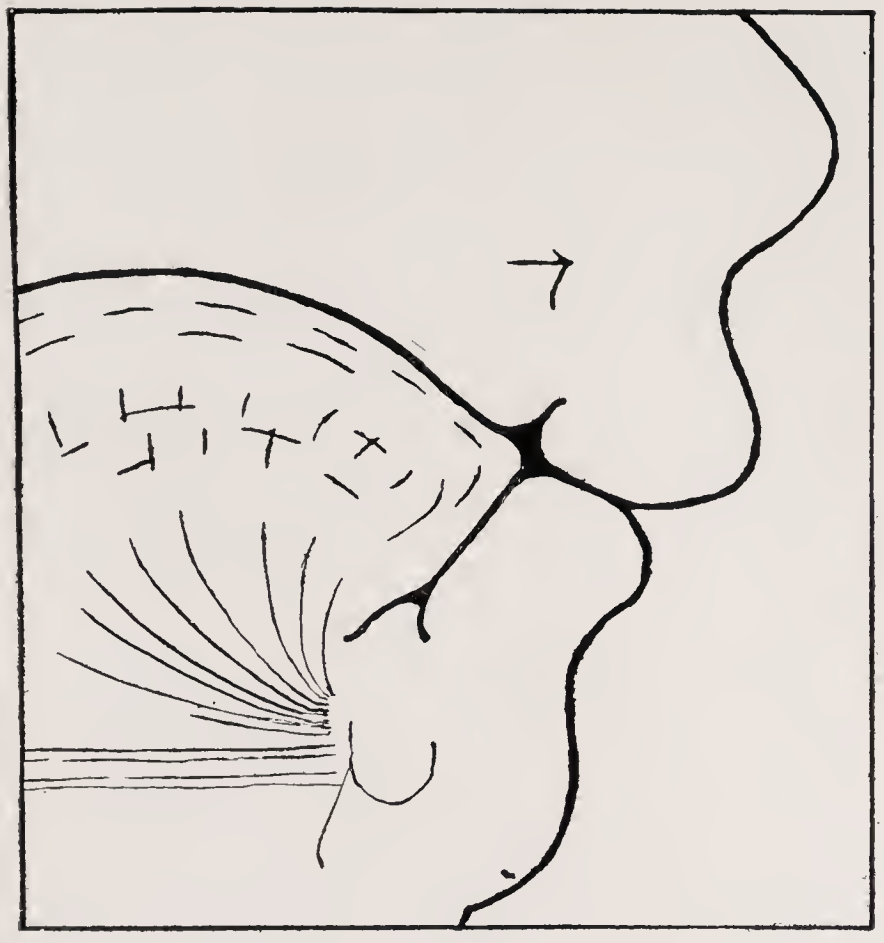

FIGURE 3.

Infant rest position. Lower lip makes principal contribution to anterior boundary of oral cavity, forming a broad contact with ventral surface of tongue.

It seems fair to say that in children with normal behaviour during swallowing one tends to find fairly ample arches with the crowns of the upper and lower incisors and cheek teeth well adjusted radially to each other. It would hold true even in the absence of normal antero-posterior cheek teeth relations. There are slight variations too in the basic set of the mandible to the maxilla in the antero-posterior plane, which children have who possess what we would nevertheless regard as a normal dentition. It would, however, become increasingly difficult for the musculature to maintain good radial relations as the fundamental set of the two jaws to one another showed increasing variations in the antero-posterior plane, but I hope to return to this complication later. I want first to describe a mode of swallowing which produces stresses unlike those of the normal way of swallowing. They cut right across the moulding forces of mastication and of normal swallowing in so far as they hinder rather than foster good radial relations. Certain dental tendencies are associated with this conflict of forces and it will help us to appreciate why these tendencies arise if we look at the behaviour closely.

It is a mode of swallowing which as far as the behaviour of the tongue, lips and cheeks is concerned is very like the behaviour of the breast feeding infant. The infant has a relatively large tongue. It fills the mouth into which the dento-alveolar structures have not yet arisen. It meets the cheeks and lips across the meagre gum pads and a point to note is that it is the lower lip rather than the upper which makes a broad contact with the tongue anteriorly. (Figure 3).

In breast feeding the tongue is moved forward, grooved longitudinally and consequently narrowed slightly as it is applied to the lower half of the areola of the breast, the upper half of which is in contact with the unyielding palate. The mandible is at first depressed. The bulk of the lower lip remains in apposition with the ventral surface of the tongue, but its everted margin lies against the breast to form a seal with it and to help support it. The margin of the upper lip completes the anterior seal. To express milk the shape of the tongue is altered. The longitudinal groove changes at the front as the anterior margin of the tongue curls up to initiate a wave of pressure on the areola, a mechanism which

Gwynne Evans has described and shown in his films. The mandible is elevated at the same time and the lower gum pad gives support from below to the upward movement of the front of the tongue. With the progressive shifting of the longitudinal grooving of the tongue from below backwards the milk is forced to the back of the mouth to be squirted with the aid of the mylohyoids through the isthmus of the fauces.

As the infant passes out of the period of breast feeding the dento-alveolar structures are slowly rising to intervene between the tongue and its previous soft tissue boundaries. In response to the changing quality of the diet the behaviour of the tongue, the lips and the cheeks becomes more specialised. The ingestion of food entails more than the primitive compression of the areola against a palate.

At one time I thought that the teeth did not reach a position of occlusion during swallowing of solids or during the " idle swallow " until getting on for two and a half years of age, but I am inclined to think one ought to add an additional three years to that figure.

Now let us suppose that at the age of, say, six years the deepening alveolar bone, carrying deciduous incisors in the process of being shed and the permanent incisors on the point of eruption, is gradually moving more into a muscular field that retains characteristics of the suckling stage. In preparing to swallow, the child first depresses the mandible from its rest position. The tongue moves forward and is narrowed. There is an accompanying drawing in of the lower lip against the ventral surface of the tongue. Despite the indrawing of the lower lip the margins of upper and lower lips are kept in contact by an eversion of the margin of the lower lip. The fleeting movements are reminiscent of the process of preparing to encircle the areola of the breast. The upper lip is pursed rather than drawn tightly back across the surface of the upper deciduous incisors. The lower lip exhibits more tension than the upper. The mentalis is tightened as well as the obicularis oris. In fact the lower lip forms a taut sling with the aid of mimetic muscles. The preliminary drawing in of an exaggerated upward scooping action as though the child were having difficulty in dislodging crumbs from the lower labial and buccal sulcus. This preliminary stage rapidly changes to a positive pressure stage which squeezes prepared food or

FIGURE 4.

Swallowing at stage of maximum contraction of mylohyoids. Lower lip with everted margin drawn back against ventral surface of tongue.

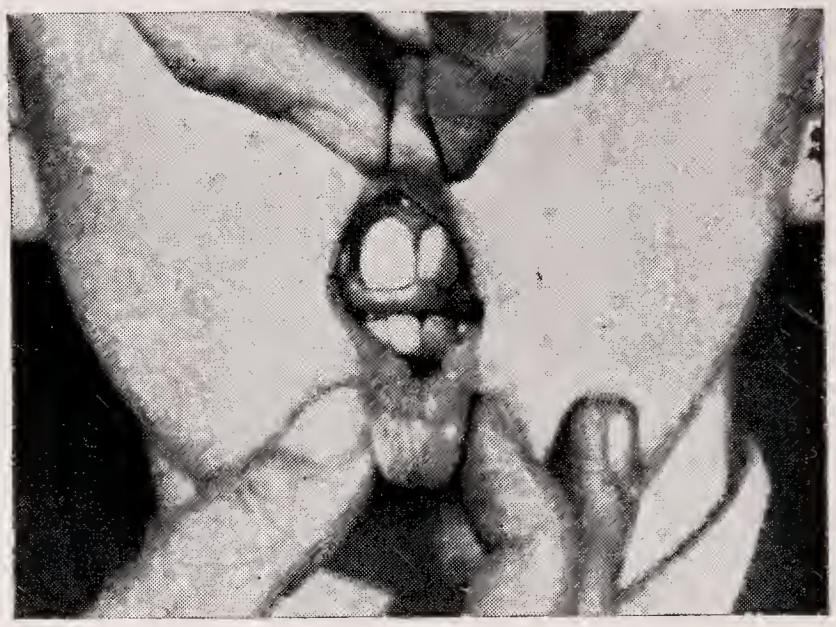

FIGURE 5.

Same timing. The teeth are separated and the tongue brought forward to exert pressure upon the upper incisors (orthodontic treatment recently started).

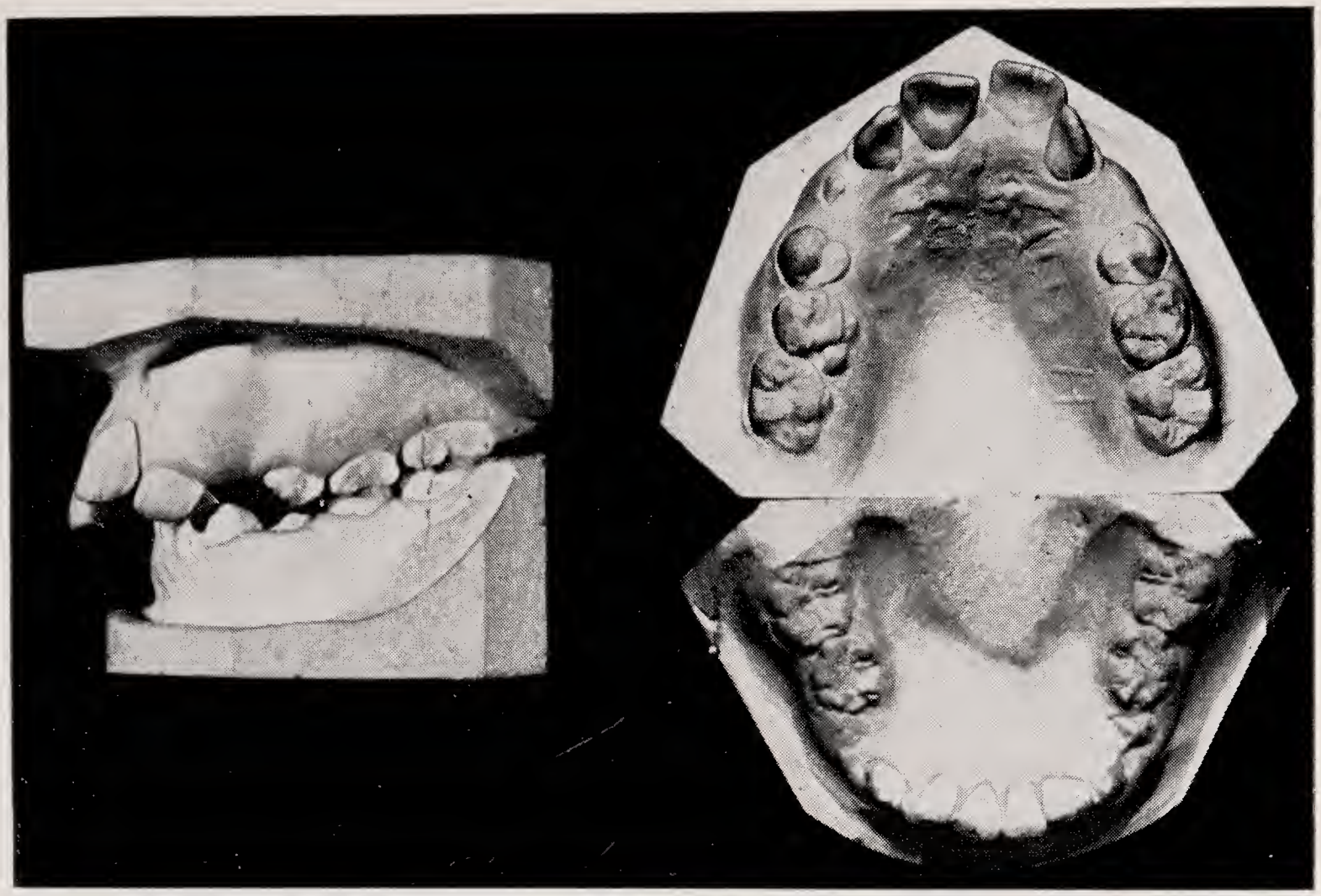

FIGURE 6.

Typical response of teeth to local behaviour which retains characteristics of the infant during swallowing.

saliva collected on the anterior half of the dorsum of the tongue back through the isthmus of the fauces. The parallel between the infant's suckling process persists in this positive pressure stage. While still being held forward the tongue presses up against the palate in the region of the on-coming permanent incisors. The thrust is accompanied by a tensing of the mylohyoids and an elevation of the mandible from the depressed position assumed in the preparatory stage. It is not elevated enough, however, to bring the teeth into occlusion. The lower lip is momentarily drawn back still more firmly against the ventral surface of the tongue, thus forming a resistant wall to aid the thrust of the anterior part of the tongue against the palate in the region of the expected incisors. (Figures 4). The emerging permanent lower incisors are repeatedly subjected to pressure from the taut lower lip while the mass of the tongue has moved upwards and forwards away from their lingual sides. With insufficient countervailing pressure on their lingual sides the lower incisors do not move adequately forwards. There is a tendency for them to be retroclined, to be flattened or to be imbricated because they are prevented from moving forward into a smooth curve. Some months later the erupting upper incisors are prevented from becoming closely applied to the lower incisors by the repeated thrust of the tongue. (Figure 5). We have thus a situation where the mechanism of swallowing brings forces to bear in the incisor regions which run counter to the moulding forces of mastication and normal swallowing, and which promote a discrepancy in the position of the crowns of upper and lower incisors in the antero-posterior plane. This incisor picture is a common cause of complaint which we in Great Britain have to deal with and it is often, though not invariably, brought about, I believe, by this particular type of behaviour. Figures 6 and 7 show the incisor relationship which results. The incisor crowns show the

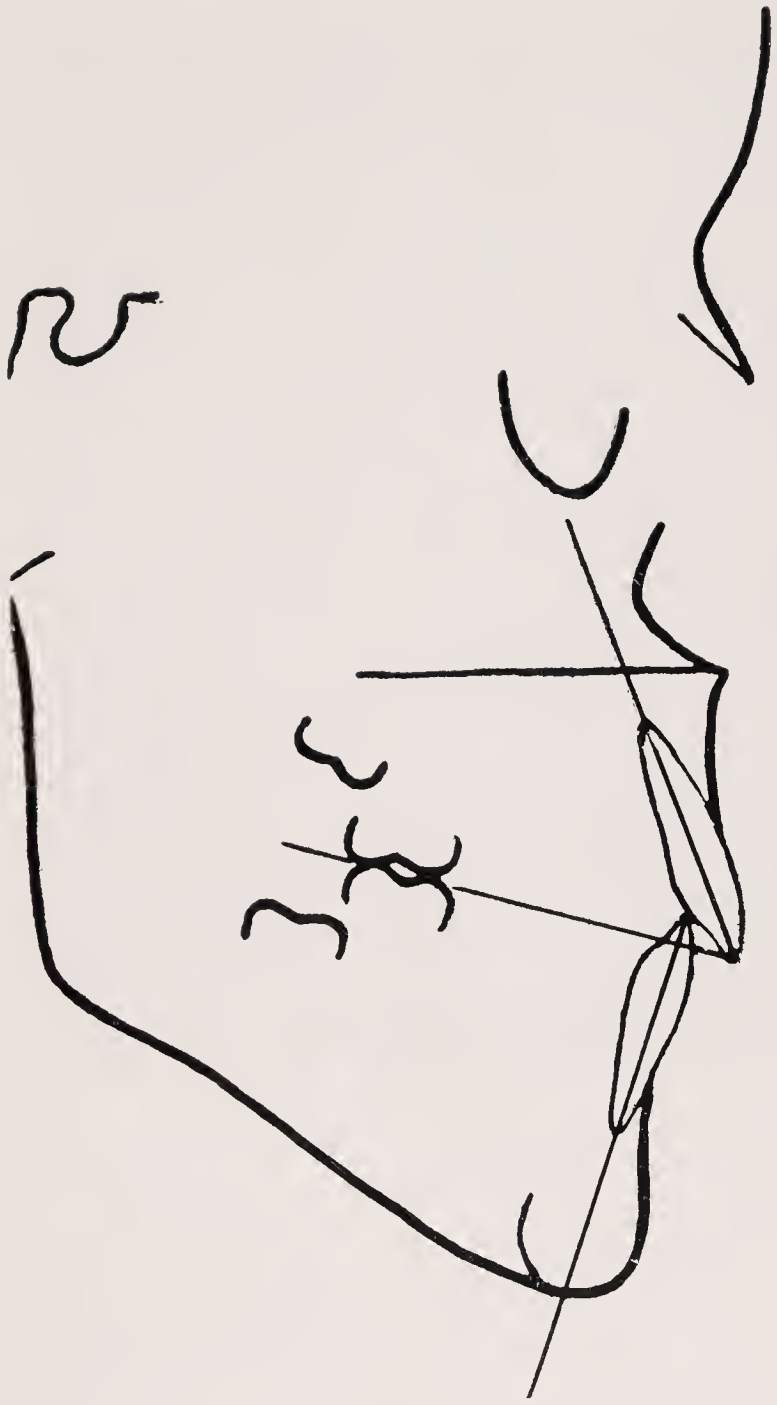

FIGURE 7.
Tracing of similar case to Figure 10 with overjet less marked. Incisor apical relationship Class III.

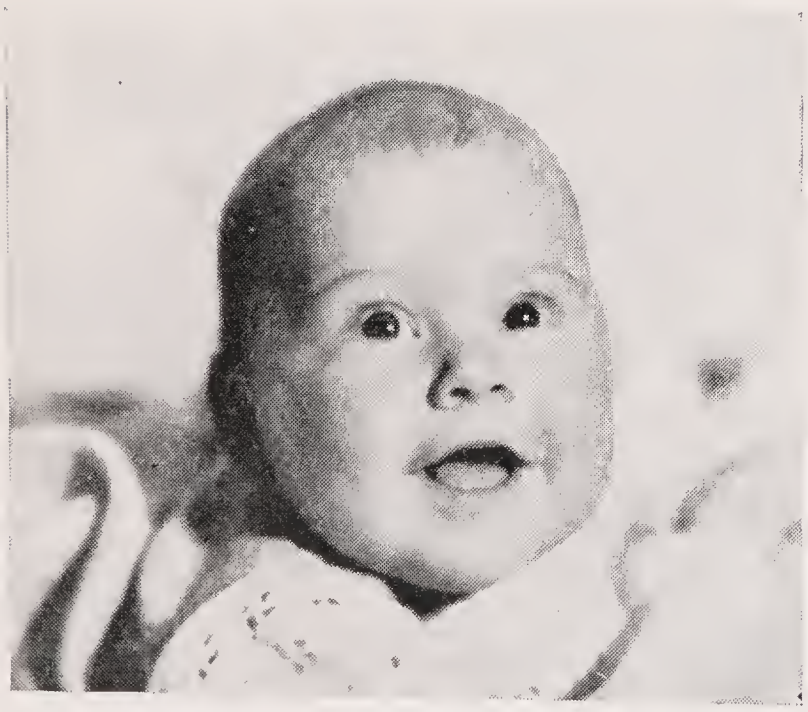

FIGURE 8.
Ventral surface of tongue maintaining contact with lower lip during changes of facial expression in the infant.

typical error in the antero-posterior plane, and with this antero-posterior error goes the adaptive adjustment in occlusal level which enables the lower incisors to maintain occlusal contact. We are all familiar with the exaggerated occlusal curve of the lower arch that accompanies these cases. Another feature to notice is the way in which antero-posterior relations become progressively worse the nearer the teeth are to the front of the mouth where the tongue and lower lip are exerting their adverse pressures. Although the " back wash " of these pressures has petered out by the time they have reached the first permanent molars in Fig. 6, I do not see why even these molars should not sometimes be affected so that they too show an error in the antero-posterior plane. The normal occlusal adjustments of the first molars which are expected during the period of six to thirteen years might well be affected. Forward migration of the lower first molars would be prevented. The shedding of the lower deciduous molars, normally providing that little extra room for the usual mesial adjustment of the 6's would merely provide opportunities for the premolars to move distally in relation to the lower first molars. In the upper arch the check to forward migration of the first permanent molars would be removed for anterior teeth are being urged forward. In this way the abnormal strains operating in the front of the mouth in a proportion of these abnormal swallowers can sometimes so affect the whole dentition that it can be labelled a Class II occlusion. Ballard has already shown that a Class II coronal relationship can be superimposed on a Class I and III apical relationship.

There is another dental defect which affects a proportion of children in this group. Instead of an excessive overbite accompanying the increased overjet they show varying degrees of anterior open bite. These children not only exhibit a suckling behaviour of the tongue during swallowing, but the posture of the tongue remains

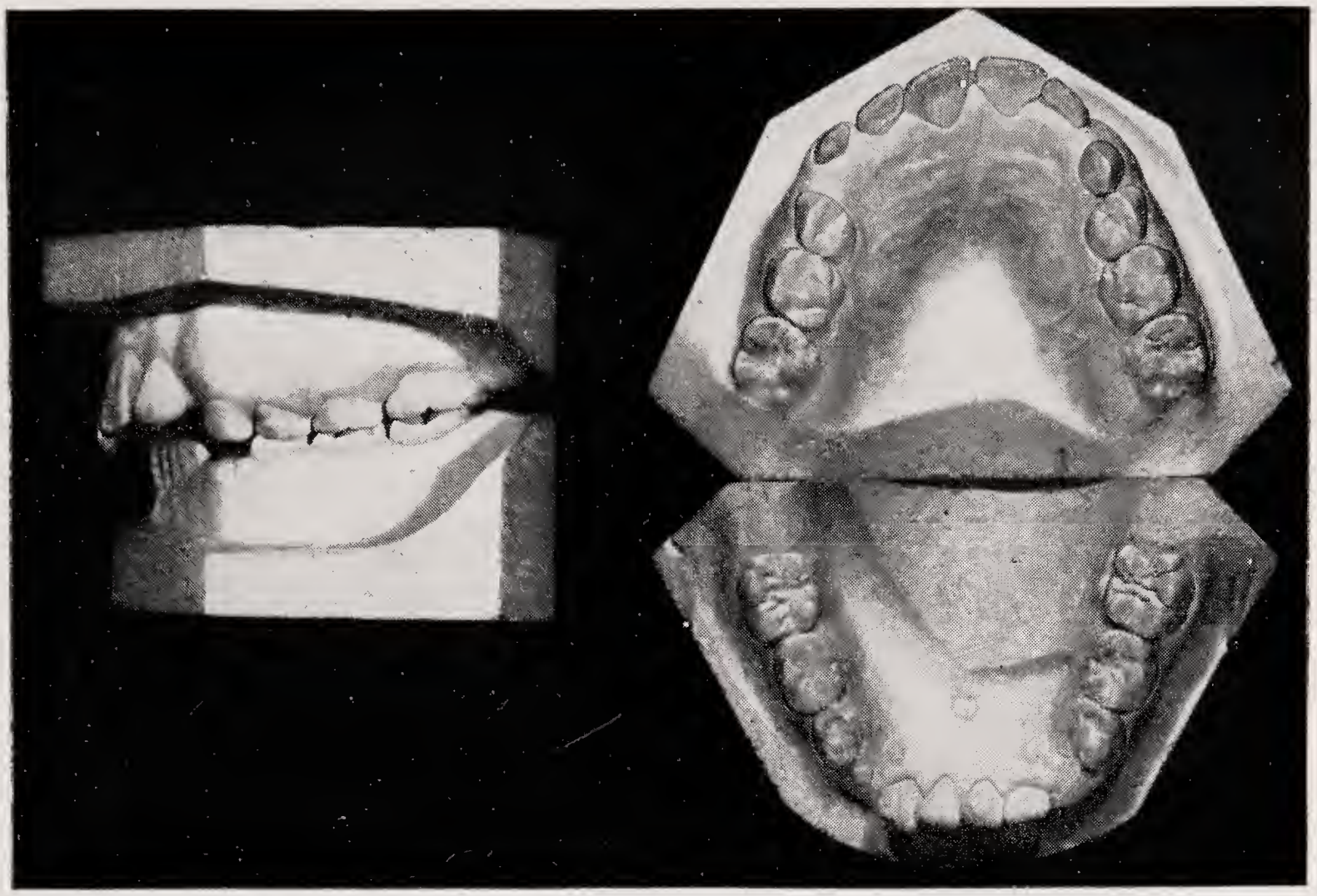

FIGURE 9.

Anterior open bite. Lower lip was continuously maintaining contact with ventral surface of tongue. Antero-posterior incisor relations showing response to behaviour during swallowing which retained infantile characteristics.

infantile throughout. Fig. 8. There is a continued contact between the tongue and the lower lip. The front of the tongue does not retreat within the dental arches. It remains forward with its ventral surface in contact with the lower lip forming a pitched roof over the lower incisors. This contact can be easily maintained while the mandible moves during changes of facial expression. During smiling, when the lip seal is broken, the tongue can be seen in contact with the lower lip. Sometimes even during speech there is a reluctance to forsake the tongue-lower lip contact and a characteristic change is produced in the sound of sibilants. Lower incisors erupting under these conditions are impeded. (Figure 9). When the upper incisors appear a little later they too are sometimes impeded in their occlusal rise, but on the whole the more forward they are guided by the suckling tongue action the less are they impeded.

In essence therefore these anterior open bite cases retain for too long an added characteristic of infant behaviour. Fortunately as the years go by it tends to be forsaken. A proportion of anterior open bites gradually improves without treatment.

Still another defect not infrequently crops up in association with these tendencies towards incisor errors in the antero-posterior and vertical planes. It is the crossed bite resulting from a relatively narrow upper arch. The subject is not strictly germane to this talk except in so far as it reduces room available for good incisor alignment, but I mention it to emphasise that crossed bites are seen where swallowing retains suckling characteristics. The bulk of the tongue is brought forward during swallowing. The cheeks are put in tension. The continuous muscular band stretching right round the dental arches from one pterygomandibular raphe to the other would tend to impinge more upon

upper cheek teeth than upon the lower.

They are not only set on a wider perimeter than the lower teeth but the raphe passes diagonally from the hamulus of the medial pterygoid above to the more laterally situated posterior end of the mylohyoid line of the mandible below.

This constricting force operates while the teeth are separated, while the bulk of the tongue has been moved forwards and while it is less capable (in conjunction with the mylohyoids) of exerting a commensurate lateral thrust upon the upper dento-alveolar structures.

Few crossed bites are to be found in the deciduous dentition where the antero-posterior arch relationship is normal. They often are seen, of course, when the occlusion is Class III but the mechanism there can be explained on different grounds. Many crossed bites develop gradually from five or six years onwards in the continued presence of this mode of swallowing.

The deformities which are supposed to result from the habit of thumb or finger sucking have not been discussed but you will recognise them as being similar to the varieties of deformities just described. It makes one wonder how far we ought to blame these sucking habits for deforming the dentition. It would seem better, I think, to say that the developmental defect which leads to a persistence of this poor oral behaviour is prone to lead also to persisting sucking habits. The habits tend to operate in mouths where conditions are already not favourable for a satisfactory dentition. The habits more often exacerbate than initiate trouble. It is on these grounds that one can explain why an occasional case of thumb sucking produces no symptoms at all.

Before leaving this subject of behaviour which tends to disperse incisor relations one might mention that the upper lip does not always continue to contribute to an anterior seal during swallowing. When the incisor relationship is moulded to a very adverse one in the way I have described the upper lip may at last cease to endeavour to make contact with the lower lip, and during swallowing a part of the upper incisors remains visible (Figure 10). The everted margin of the lower lip makes a seal with the upper incisal edges and with the ventral surface of the front of the tongue. It is an inelegant way of making a seal, but a tongue pressed against the back of the upper anterior teeth and supported by a taut lower lip makes a perfectly efficient one for the purpose of swallowing. This late inability of the upper lip to remain normally covering the upper incisors can thus be secondary. There is a

FIGURE 10.

Behaviour showing suckling characteristics during swallowing, the taut lower lip creating a "smile." Permanent Upper Central incisors uncovered by lips. Deciduous incisors had been covered during swallowing.

discrepancy in upper and lower incisor relationship, but not because of a primary failure of the upper lip. The upper lip has merely become physiologically redundant. I do not wish to infer, however, that the upper lip can fail to make a proper seal during swallowing solely on account of a poor incisor relationship which arrives at the age of six or seven years. There are upper lips which do literally seem to be short. There are lips which even during the first years of life have come to be quite superfluous to the making of an anterior seal during swallowing because of a very poor incisor relationship in the deciduous dentition. Just as later on a poor permanent incisor relationship can enable or encourage an efficient seal to be made without the aid of the upper lip, so a poor deciduous incisor relationship can cause an upper lip to fall into still earlier disuse. The only difference, as I see it, between learning to swallow without using the upper lip thus early and learning the same habit at, say, seven years is that the early habit follows a primary discrepancy of the deciduous incisor area, which it incidentally tends to fix, while the late habit can follow an incisor discrepancy of the permanent dentition which may have newly arisen from the moulding forces of adverse muscular behaviour.

Careful watching of the lower lip of a child in the process of swallowing without using its upper lip and thus exposing the permanent upper incisors to view brings to notice two main ways in which the lower lip operates to form a seal. It can be drawn back and upwards forming a taut sling, the action appearing to be laborious, or it can move behind the upper incisors with little effort. If one looks further and tries to see what the tongue does in these two types of lower lip behaviour one discovers that the tongue of the child with the taut lip has moved forward enough through the separated incisors to cause the lower lip to be lying against its ventral surface, recreating the old infantile contact between the lower lip and tongue. The tongue of the child with the inert lower lip has not moved forwards. The teeth are not separated much, or they are not separated at all, and the lip is merely trapped between upper and lower incisors. I think it is helpful to try to recognise the difference between these two variations of behaviour for an improvement is more readily obtained in the incisor relationship of the child with the inert lower lip. Now I want to turn to another easily defined though less frequent mode of swallowing.

There is a polarity between certain dental deformities which is most unlikely to be accidental. The association between a crossed bite and retroclined upper and lower incisors is rare; so too is the association between anterior open bite and retroclined incisors. Children with retroclined incisors usually have good radial relations with an excessive incisor overlap. If the mode of swallowing of these children is watched it is seen to have lost its essential suckling character. The tongue is not raised and moved forward to exert a thrust in the upper incisor region to propel food or saliva back towards the isthmus of the fauces akin to the compression of the areola of the breast to express milk. The tongue stays within the dental arches. The lower lip does not lie against the ventral surface of the protruded tongue, nor does one ever see these children maintaining that infantile resting contact between the tongue and lower lip that we see associated with anterior open bites. The mode of swallowing is, however, abnormal in other respects. The teeth are separated in the act. There is obvious tension of the sealed lips taking them back towards the withdrawn tongue (Figure 11). As the lower incisors erupt they fail to move adequately forward. They tend to be retroclined and to show similar errors already described for the behaviour which disperses upper and lower incisors. Admittedly there is a

FIGURE 11.

Swallowing with teeth separated. Both lips in considerable tension. The tongue is staying within the dental arches and is not in contact with the lower lip.

FIGURE 12.

Models of girl in Figure 11 *showing retroclination of upper and lower incisors*

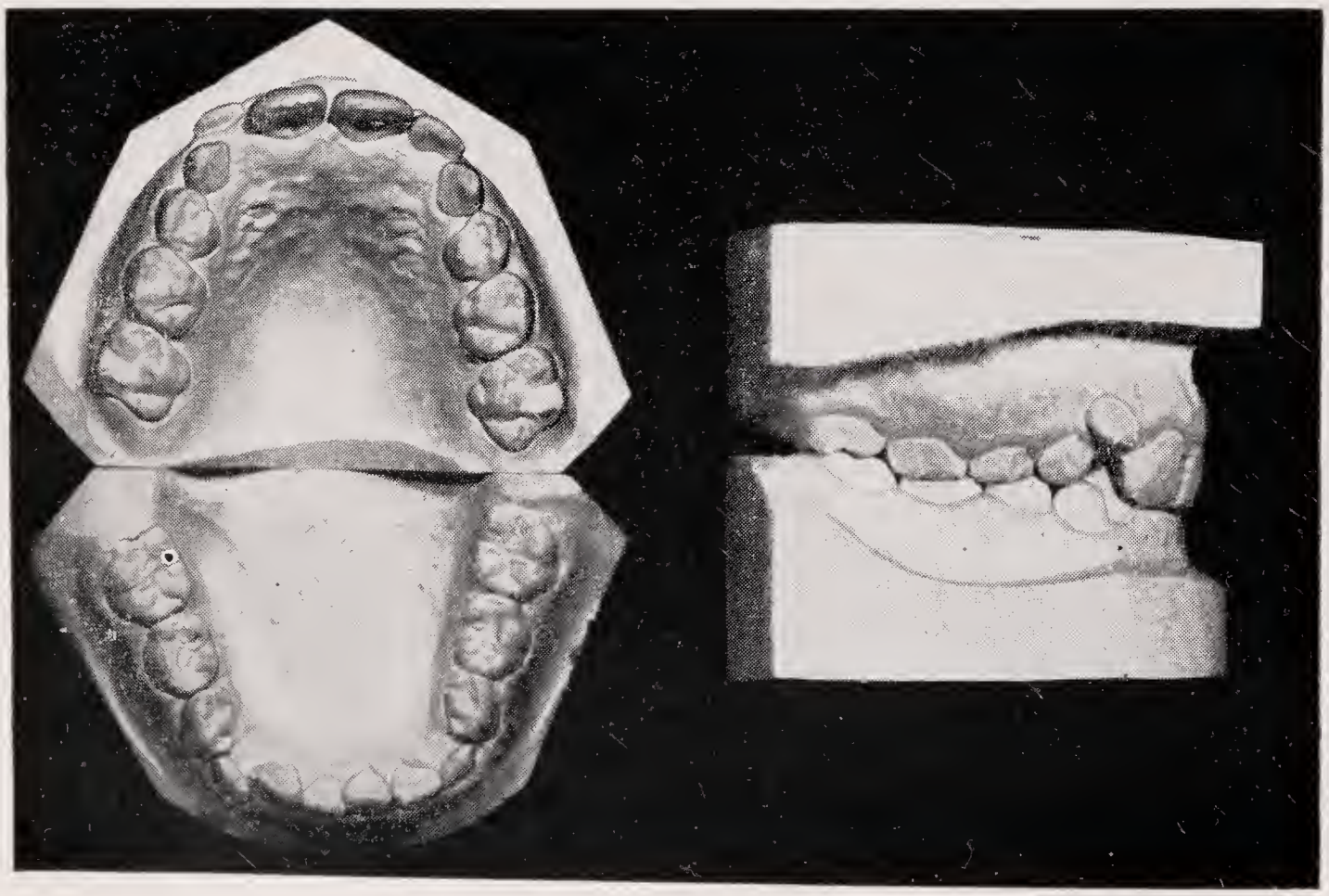

FIGURE 13.

Tracing of girl with similar behaviour to that shown in Figure 11 *showing retroclination of incisors.*

forward pressure on the lower fronts exerted by the tongue acting in conjunction with the mylohyoids but the comparative inactivity of the lips seen in normal swallowing is missing. The lower incisors are subjected therefore in this abnormal mode of swallowing to an added resistance from the front.

As the permanent upper incisors subsequently move down into this adverse muscular field they too are subjected to the extra resistance of the tense upper lip. They too fail to assume a normal inclination. They tend towards retroclination (Figures 12, 13). By the time they are fully erupted their tips lie well inside the lower lip whose tension controls them with equal efficiency. The more they are retroclined the more the crowns are lowered behind the lower lip. The perimeter of the anterior part of the dental arches tends to be lessened and some degree of imbrication of the teeth becomes necessary. The retroclination leads to an increased overbite, a condition which comes about without any secondary occlusal rise of lower incisors, but which nevertheless can be increased still more by secondary rise if local opportunities permit.

While talking of this group with tendencies towards incisor retroclination I would like the opportunity of showing Figure 14 to demonstrate that the failure to seal the lips *when at rest* has no tendency in itself to produce proclined upper incisors. This child performed oro-nasal breathing perforce. Her nares were pinched and desquamating. Her mode of swallowing was abnormal in the way I have just described. Her upper incisors had not received the stresses that the suckling behaviour would give them. The upper and lower incisors stayed slightly retroclined despite a lack of lip seal.

The absence of crossed bites in these cases with tendencies towards incisor retroclination I take to be due to the fact that the front of the tongue during swallowing remains blunt and stays within the dental arches which are flattened anteriorly, thus in no way diminishing its thrust upon the upper cheek teeth.

Earlier I tried to make the point that during the act of mastication the same balanced interplay of the internal and external musculature which positioned food precisely between the teeth provided a muscular environment which fostered upper and lower arches with well knit radial relations. The abnormal type of swallowing just described does nothing to upset good radial relations. It is the suckling behaviour of tongue and lips during swallowing which disrupts radial relations.

There is a feature in both varieties which is interesting. It is the degree to which the mandible is separated from the maxilla at the moment of swallowing. In a dozen cases where swallowing was suckling in

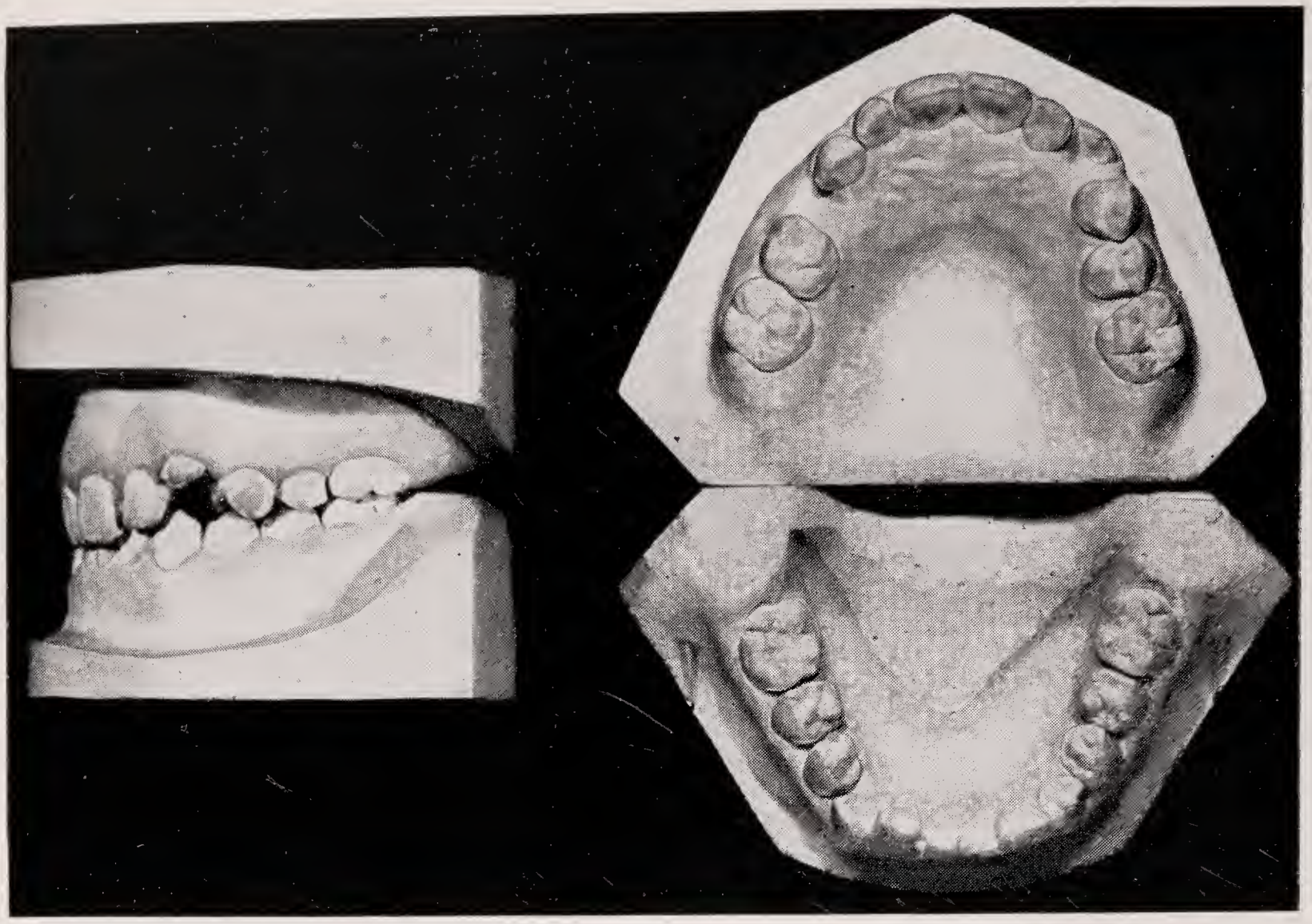

FIGURE 14.

Incisors moulded to position of slight retroclination by similar behaviour to Figure 11 *during swallowing. Lips always parted in rest position. Oro-nasal breathing.*

character and where there were various degrees of overjet the separation of the mandible (measured in the incisor region) varied from 2mms. to 9mms. (Table A).
In a second group showing fundamentally good radial relations and varying degrees of incisor retroclination the mandible was separated from 2mms. to 7mms. (Table B).
In both groups where the *widest separation* of the mandible was seen there was the *deepest overbite*. At the other end of the scale where the separation of the mandible was less the overbite was less or there was

GROUP A.

	Overjet mm.	Overbite mm.	Separation of mandible mm.
G.H.	11	6.5	9
B.P.	10	6	9
M.W.	6	5	8
V.W.J.	9.5	5	7
A.B.	3.5	4	6
C.B.	4.5	4	6
B.L.	8	3	7
C.S.	3.5	nil	7
D.H.	4.5	–1	3
P.N.	7	–2	4
D.B.	3	–2	3
S.H.	6.5	–3	2

GROUP B.

	Overjet mm.	Overbite mm.	Separation of mandible mm.
C.St.	nil	8	7
G.B.	nil	8	6
P.R.	nil	6.5	5
E.M.	1.5	6	6
D.L.	nil	6	4
A.M.	nil	5	3
K.McC.	nil	5	3
D.T.	nil	5	2
D.M.	2	4.5	4.5
G.M.	nil	4.5	4
C.W.	nil	4	4
A.W.	nil	4	2

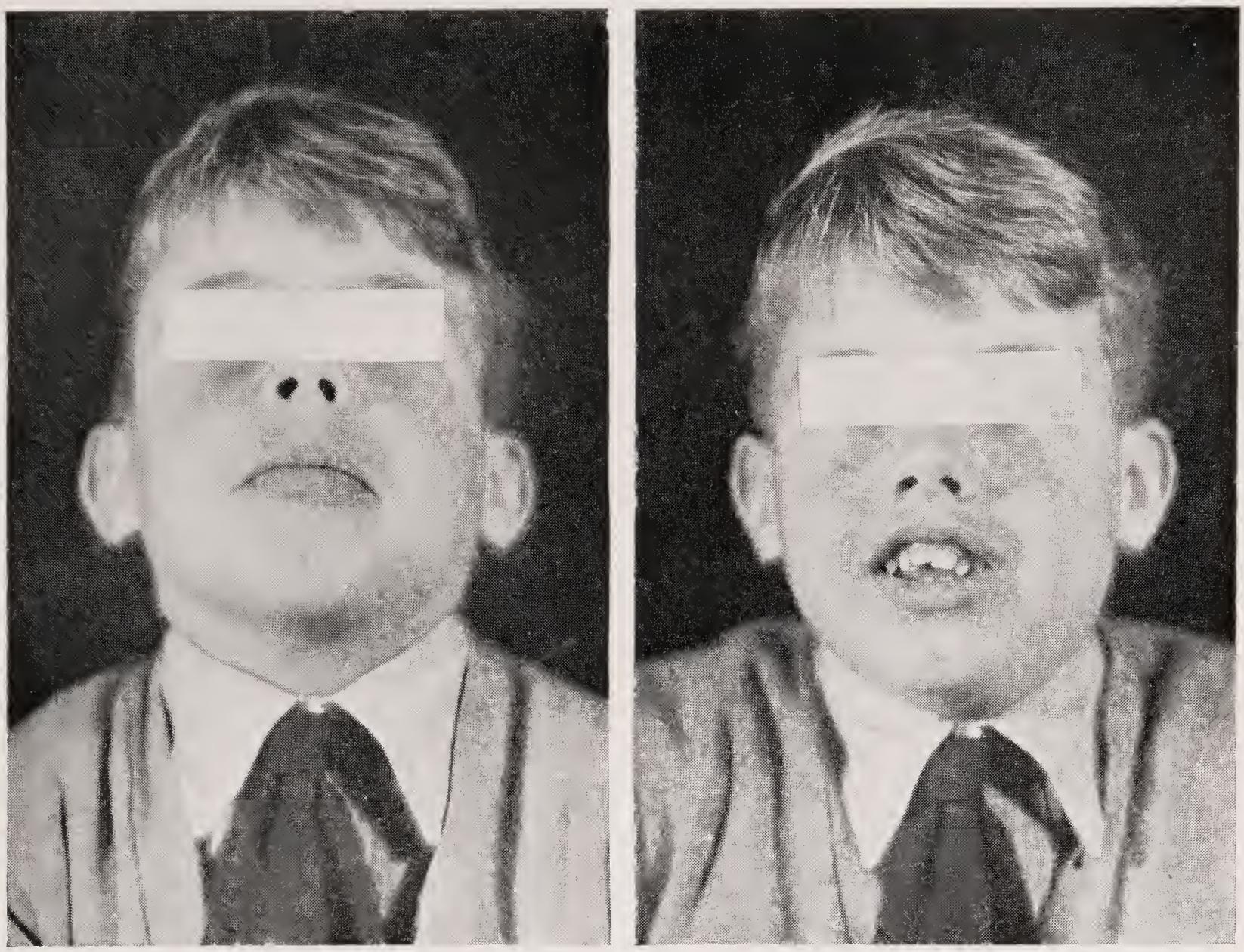

FIGURE 15.

Behaviour showing suckling characteristics during swallowing associated with lips apart in rest position.

an anterior open bite. This is an interesting enough correlation to warrant more investigation.

A brief mention has been made earlier of lips which are not sealed when the child is at rest. One sees parted lips with well positioned incisors, with proclined and retroclined ones. Parted lips at rest are not related to any particular incisor picture and do not seem to have any direct adverse moulding effect upon the incisors. I do not think that parted lips by themselves even encourage a treated case to relapse, but they can be a pointer to other behaviour which is damaging to good incisor relationship. The lower lip which is drawn back against the ventral surface of the tongue during swallowing is the very lip which will often fall away from the upper lip when the child is at rest. It is the less obvious behaviour during swallowing which is damaging rather than the passive failure of the lips to remain together during rest. (Figure 15).

Although I have picked out for particular description certain recognisable and contrasting modes of swallowing which are associated with contrasting trends in the position and relationship of the teeth there are others which are of differing types and of differing intensity. I do not pretend to know much about them. The suckling tongue behaviour tapers away in some children to what seems to be a closing down of the teeth on a soft and bulging tongue. The tongue is not tensed and moved forward to bring an upward thrust against the lingual surfaces of the upper incisors

and adjacent palate. Neither upper or lower lip is particularly active and there is no eversion of the margin of the lower lip. The whole act is not reminiscent of suckling except for the sight of the tongue between the arches if the lips are parted with the fingers. Then there is a wide separation of the dental arches during swallowing in cases with postural prenormal occlusion. As you know they have an excessive overbite. The separation is such that the overbite is usually reduced to nil. The tongue does not protrude between the incisors though it does have the opportunity of protruding between the cheek teeth. This type of swallowing bears no resemblance to the behaviour of the suckling infant. Since postural prenormal occlusion can be accidentally produced by the early loss of deciduous molars it would seem that the mode of swallowing here is secondary to the position of the teeth.

As for the response to treatment of the incisors in the two contrasting types of muscular behaviour during swallowing which I singled out earlier for particular description it would be right to call it patchy. In many cases the suckling tongue behaviour gradually becomes modified or less intense. The fact that a proportion of anterior open bites improve naturally encourages the view. Behind a dental deformity the behaviour which brought it about may already be sufficiently improved to support an improvement in the positions of the teeth if only someone will insert the appropriate apparatus, and it seems to me that treatment of deformities associated with the suckling tongue should begin early to afford the child as many formative years as possible with an improved dentition. Errors of radial relations of the teeth have little opportunity for natural correction. The crossed bite is fixed by the stresses of mastication operating on the adverse cuspal lock of the cheek teeth. The poor antero-posterior incisor relationship enforces the lower lip wholly or in part to remain between the incisors whenever an anterior seal is made. One can often break into these vicious circles with some degree of success.

As for treatment of the second variety of cases with upper and lower incisor retroclination it is more difficult. The oro-facial muscular behaviour pursues its predestined course despite improvements which may be made in the position of the teeth with appliances. Retroclination and imbrication tend to return and one's thoughts are led towards making a reduction in the number of teeth. Opportunities then occur for further retroclination. I am doubtful whether early orthodontic treatment has any advantage in this group.

In closing I should point out that my remarks have been made with no special reference to fundamental antero-posterior errors in the relationship of the apical area of the upper and lower incisors to each other for I have wanted to bring out primarily the effects of the musculature on the position of the crowns of the incisors. The work of Downs, contrasting the angles S.N.A. and S.N.B., the work of Björk with his angles of upper and lower prognathism, Ballard's studies of skeletal patterns all in their way show that there are fundamental errors in incisor apical relationship. It alters to varying degrees the response of the incisor crowns to the two contrasting muscular environments which I have described, and it is of importance when treatment is being considered. The region of the apices of teeth is more remote from the muscular activities described and therefore less susceptible to their adverse pressures. It seems to be well recognised that both the growth of the skeleton and muscular behaviour are predominantly under genetic control. The interplay of these two systems leads to interesting and not unexpected results. Where, for instance, the apical area of the upper and lower incisors bears a Class III relationship the persisting suckling behaviour during

swallowing would tend to fail to produce as large an overjet as one would see if the incisor apical areas were more normally related Fig. 7. On the other hand it would all the more easily cause the upper cheek teeth to move into a crossed bite position. In cases where the incisor apical area bears a Class II relationship the same muscular environment would tend to mould the upper and lower incisors into a relationship producing a more severe degree of overjet. There would be less tendency for crossed bites to appear, and the lower incisors would show less retroclination.

In cases with a Class II incisor apical relationship which exhibited the " blunt tongue " swallow there would be a marked retroclination of the upper centrals and an excessive overbite which would render treatment difficult. The more that is known of the interplay of skeletal growth and muscular behaviour the more clearly can the unfortunate practising orthodontist see how best to make a feasible compromise with Nature. I call him unfortunate for not only is so much more to be known, but much vital information must always remain unavailable to him unless he is a prophet. How, for instance, can he know what slow changes may come about naturally in the antero-posterior relationship of the incisor apical area which Brodie, Downs and Björk have demonstrated. How too can he guess what modification can be achieved in muscular behaviour.

I would like to take this opportunity of thanking Mr. Howell Richards for his help in preparing some of the illustrations.

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DISCUSSION

Mr. C. F. Ballard said that it gave him great pleasure to open the discussion on the paper.

He would like to congratulate Mr. Rix on being the first orthodontist to give a detailed and, as he believed, an accurate description of the various abnormal behaviour patterns of the tongue, lips and cheeks, which were probably the sole cause of many dental abnormalities. As most of the members would recollect, it was Mr. Rix who had originally related the abnormal swallow to certain dento-alveolar irregularities. He himself, as Mr. Rix knew when suggesting that he should be the opener of the discussion, had been interested in these behaviour patterns for many years, and he therefore thought that he was in a position to say that Mr. Rix had not

missed anything in his observations and had in fact added a few points to those which he himself had observed. There was therefore little that he could add, but he would like to stress the importance of Mr. Rix's observation confirming one which he himself had previously made, namely, that many postnormal occlusions were secondary to an incisor overjet produced by abnormal behaviour of the tongue and that therefore the treatment was not an attempt to shift the mandible forward to correct this postnormality (if one believed that that could be done—or the dentition, if one did not), but must be a distal movement of the maxillary cheek teeth prior to the correction of the overjet.

The particular aspect of these abnormal behaviour patterns which had interested him for some years was their origin, and in that connection he was not entirely in agreement with Mr. Rix. He was not at all convinced that the abnormal swallow could be said to be a continuation of the infantile swallow. A film of Mr. Gwynne-Evans' had shown quite clearly that the infant tongue during swallowing was not thrust forward but was elevated by the mylohyoids, that the longitudinal groove then formed received the feed and that then the peristaltic wave commenced by a flip of the tip of the tongue against the upper pad. He thought that really was the precursor of the normal swallow. It seemed to him that in the abnormal swallow the mechanism was entirely different. During the abnormal swallow the tip of the tongue did not come upwards at all; it was definitely pushed between the teeth beyond what was the equivalent of the upper gum pad, and that produced the proclination of the upper incisors.

In Class III cases there was exactly the same type of tongue thrust, but, because of the difference in skeletal pattern, the tongue thrust against the lower incisors under the upper incisors well beyond where the gum pad must have been in the infant.

He quite agreed with Mr. Rix's association of the resting position of the tongue between the teeth, and he thought that the prognosis for re-educating that tongue position was poorer if, associated with this, there was an interdental sigmatism. The speech therapists could eliminate the interdental sigmatism, but they could not eliminate the position of the tongue between the teeth at rest and the abnormal swallow which invariably accompanied this resting posture. He had thought originally that many of these abnormal swallows resulted from an abnormality of the skeletal pattern in early childhood, and that behaviour patterns of the lips and tongue during swallowing became abnormal in their attempt to adjust themselves to this abnormality. That should be capable of statistical analysis, but, without that, he was now convinced by his own observations that it could not be entirely true. Many abnormal swallowing actions were based on an entirely normal skeletal pattern, and many were present in early childhood when every other factor appeared to be normal. He had examined a large number of children between the ages of 2 and 5 years; the abnormal swallow was present in a considerable percentage of them (although most of these children with an abnormal swallow had a normal skeletal pattern), and its manifestation in the deciduous dentition was a slight degree of increased overjet and reduced overbite in the incisor region. As Mr. Rix had pointed out, this became a definite Class II, Division 1, incisor relationship or an open bite when the permanent teeth erupted. He still felt that a likely explanation of this abnormal swallow was that it was inherited. In the case of several families he could trace the abnormal swallow back to a grandparent, and in one family in particular it seemed to be a dominant characteristic from the grandmother. That did not, of course,

eliminate the possibility that it was a persistent infantile swallow, and that the persistence was due to either an inherited failure or delay of maturation in the neuromuscular patterning of swallowing. However, he was more inclined to the view that, in a high percentage of the cases, in some way or other it was an abnormal behaviour pattern which was inherited, was present before birth and was almost impossible to eliminate.

As he had already said, from a careful analysis it appeared that these abnormal swallows were entirely different from the infantile pattern. It was well known that certain characteristic movements of an individual appeared to be obviously inherited. Why should not that apply to the swallowing mechanism, which had to be present at birth as a mature pattern for the survival of the infant? There was, in his opinion, one other method by which it could be shown to be inherited, namely, if it could be demonstrated that the anatomy of the musculature of the tongue in these cases was in some way abnormal and they could not therefore control it during swallowing as they should for the normal movement. That idea was perhaps supported to some extent by the observation that some of these people could not control the tongue even to the extent of eliminating an interdental sigmatism, and that was so even when a speech therapist attempted to re-educate them.

One other explanation of these abnormal swallows, an explanation which one commonly found in the American literature, was that they were due to a mal-relation of the infant to the mother during breast feeding. He had taken careful histories of a large number of cases and could not find any correlation at all; it must be remembered, of course, that amongst middle-class people in America, that is those who could afford orthodontic treatment, it was not the custom for infants to be breast-fed.

In Class II, Division 2, types of incisor relationship, he agreed with Mr. Rix that one had in some way or other to relate, perhaps statistically, the abnormal behaviour pattern and the skeletal pattern. An American—Johnson—had already shown that there was a correlation between the skeletal pattern and Class II. Division 2, occlusal abnormality, so there might be a relationship between skeletal morphology associated with Class II, Division 1, and the behaviour pattern of the soft tissues.

Again, he agreed with Mr. Rix that an overjet was not necessarily related to incompetent lips. He thought the important factor was whether or not the skeletal pattern was normal or abnormal.

He would have liked Mr. Rix to relate his observations on the excursion of the mandible and the overbite to the free-way space and the physiological rest position. He thought that should be done by somebody.

There was one other factor which might be significant in this position of the tongue. Anatomists had failed to demonstrate any proprioceptive fibres in the tongue, and, if one examined some of the cases in which there was a tip of tongue to lower lip resting posture and one pulled the lower lip away from the tongue, one saw it receding into the mouth. He wondered whether that posture was maintained by the reflex action of the contact of the tip of the tongue with the lower lip. He could not say how it arose originally.

He thought that the significance of the paper was, as Mr. Rix had pointed out in his summary, that the Americans had provided methods of assessing skeletal pattern. It was well known that with normal muscle pattern and normal dental base relationship there were cases of overcrowding. The most important factor, which had so far escaped American orthodontists and, he thought had escaped Continental orthodontists to the extent that Mr. Rix had put it forward in his paper, was the question of the abnormal muscle pattern and the abnormal pattern of soft tissues being significant in relation

to the prognosis of a case and the amount of tooth movement that one could produce, and the compromise which must be the result in many cases.

He would like to congratulate Mr. Rix on having given a very original and comprehensive survey of the subject, which should contribute much to the elimination of empiricism from orthodontic treatment.

Mr. GWYNNE-EVANS said that he appreciated the President's kindness in inviting him to add a few words in the discussion. He had thoroughly enjoyed Mr. Rix's paper, which had been very enlightening to him, and he agreed with nearly all that Mr. Rix had said, but he supported Mr. Ballard in questioning whether some of these abnormal patterns of behaviour were truly infantile.

In 1948 he had followed up the observations made originally by Mr. Rix, by describing the process of maturation, as they affected the feeding and breathing mechanisms, along the lines used by Arnold Gesell in his studies on the development of the child. In 1951 he had traced the evolutionary changes that took place in the feeding and breathing mechanisms from fish to man, and he had then gone on to observe the different patterns of oro-facial behaviour in suckling, sucking and swallowing in early life, with the hope of discovering the origin and nature of certain atypical characteristics which had been seen later in life. In the course of this work he had begun to realise that the orofacial muscles occupied a functional position between the somatic and visceral systems. They appeared to behave, in some activities, like somatic or skeletal muscles, as they did in speech, and, in other activities, as visceral muscles, as they did in feeding. Generally speaking, somatic or skeletal muscles were grouped together under the control of the central nervous system. They contracted rapidly, and their behaviour could become highly differentiated. Visceral muscles were under the control of the autonomic nervous system, and they were largely concerned with the vegetative functions of life. They responded slowly in peristaltic waves, and their behaviour did not become highly differentiated.

In suckling, the transfer of milk was directed continuously through the mouth to the pharynx by an automatic visceral type of behaviour in the tongue and the mylohyoid muscles. In the sipping or drinking of fluids, peristaltic waves were deliberately initiated in rapid succession to pass fluids to the pharynx. In the swallowing of soft or solid food, a single wave of contraction in the tongue and the mylohyoid muscles initiated the transfer of the food to the pharynx. When, in swallowing, the teeth were together, as Mr. Rix had described, the lips, although closed, were not actively employed. When, in swallowing, the teeth were not together, it seemed to him that the visceral type of behaviour of the tongue and the mylohyoid muscles included the orbicularis oris, the mentalis, the zygomatic and the buccinator muscles, in a peristaltic wave which was initiated in the lips and passed backwards through the mouth to the pharynx. He had examined a large number of children, and this peristaltic wave passing from the lips backwards seemed so typical that it might be of significance.

He thought that this type of behaviour had many variations of detail, a number of which had been shown by Mr. Rix on the present occasion. It could be seen in older children and, on occasions, even in adults.

There were therefore these two broad types of behaviour, and both were so frequently seen that it was difficult to say which was normal and which was abnormal. Some children seemed to accentuate the visceral pattern of behaviour and some did not. One type seemed to be associated with a normal occlusion and the other with an abnormal occlusion, such as had been described by Mr. Rix.

It was difficult to believe that the visceral type of behaviour was purely an infantile pattern or a suckling pattern, as it could so often be seen in the later years of childhood and as it was so difficult to alter by re-education through orthodontic or other means. Even the normal processes of maturation seemed to fail to bring about a change to the normal pattern.

So far as his investigations had gone, it seemed only possible to obviate adverse effects on the alignment of the teeth by orthodontic appliances, until the patient was old enough to modify his pattern of orofacial behaviour in feeding and swallowing by conscious adaptations, which, by frequent practice, became fixed as acquired patterns of behaviour. If that was not possible, orthodontic treatment might in a number of cases be of no avail.

Miss L. M. CLINCH said that she was grateful to Mr. Rix for having solved one of the problems which had always perplexed her, namely, the difference in the incisor condition with lips which were apart habitually. As Mr. Rix had pointed out, one can have any position of the incisors with the lips apart; at rest, either normal, linguoclinated or proclinated, and the lips do not appear to have any effect on them.

Mr. J. H. HOVELL said that he had listened to the paper with very great pleasure and he thought that everyone present should be grateful for the opportunity of listening to a really epoch-making paper. It was a contribution to the science of orthodontics such as one was not often privileged to hear. He did not think that what Mr. Rix had said about tongue action and swallowing could be contradicted by any orthodontist.

He would like to ask how Mr. Rix measured the excursion of the mandible during swallowing, and he would also like to know whether he had correlated the excursion of the mandible with the freeway space, particularly in the case of retroclined incisors, and whether in the teeth-apart swallow he had observed, whether with the mandible in the rest position the tongue rested between the teeth or lay inside the oral cavity.

He thought that there was a difference between the incompetent lip posture and the lips-apart posture. The lips-apart posture was often associated with mouth breathing, and then it was not a true lips-apart posture. The real posture in those cases was with the lips together, and there was actually a competent lip posture. Although the child had his lips apart most of the time; this parting of the lips was due to a dropping of the whole mandible, as an active movement in order to bring about the necessary separation of the lips, and was therefore a post-orally abnormal resting position.

He thought that there was much more likelihood of a disproportion between the soft tissues occurring when there was a postnormal skeletal pattern. Mr. Rix had shown that with a normal skeletal pattern the faulty swallow could produce Class II, Division 1, but in Class II skeletal pattern incompetent lip posture could very greatly accentuate the postnormal relationship of the incisor teeth, quite apart from any faulty swallowing habits. When Mr. Rix stated that an incompetent upper lip posture followed a primary faulty lip relationship in the deciduous dentition, it should have been said that it followed a primary faulty skeletal pattern and then accentuated the faulty incisor relationship which was dependent upon that skeletal pattern.

With regard to the posture in Class III cases, with postural prenormal occlusion, did not Mr. Rix think that the teeth-apart swallow was due to the fact that there was a true over-closure with an increased freeway space, and that the child swallowed with the jaws in their true normal occlusal relationship?

In the case of retroclined incisors, did Mr. Rix find that there was always a teeth-apart swallow, and, if not, could he say in

what proportion of cases it was found? He had tried to examine cases with that point in view, and he had only infrequently found a teeth-apart swallow with a double retroclination or with a Class II, Division 2, type of incisor relationship.

Miss K. C. SMYTH said that she was glad to have an opportunity of expressing her gratitude to Mr. Rix for his very interesting paper. It brought muscle action to the fore in a way which must surely be good for all orthodontists, and she thought that the members must feel proud that such a paper had emanated from the Society.

She would like to ask Mr. Rix whether, in a case of postnormal occlusion, where there was a marked close bite, it was possible to have a tongue thrust at the same time. She thought that she had seen such cases, but she had not been able to prove it to her own satisfaction.

Mr. N. GRAY said that he would like to thank Mr. Rix for his paper. Ever since he had seen Mr. Rix's film on tongue habits during "swallowing" he had kept a careful check on all cases.

He would like to have heard a little about some methods of treating this habit, because it seemed to Mr. Gray that it was one of the big problems which faced all orthodontists. Very often thumb-sucking was followed by a tongue-thrusting into the deformity made by the thumb. If one put a plain lingual arch, with a parallel screen, hanging down behind the upper incisors, it had a remarkable effect on the tongue habit. If one put a double labial arch in front of the lower incisors it held the lower lip away and improvement in development occurred as one in some measure erased the lower lip habit.

Mr. W. J. TULLEY thanked Mr. Rix for his most interesting paper. In view of Mr. Rix's previous paper on Deglutition he wondered whether Mr. Rix still related these atypical patterns of behaviour to upper respiratory troubles in infancy.

The PRESIDENT said that Mr. Rix had shown such a variety of cases associated with abnormal swallowing habits that he wondered which were the cases that did not have those habits. Perhaps Mr. Rix would tell the meeting a little about that.

He was reminded of the review of research work during the last five years which Professor Lundstrom had given at the International Dental Congress, in which he, Professor Lundstrom had remarked that the teeth might be the cause of habits or habits might be the cause of the teeth, and, of course, the two might go together and be part of a syndrome.

He would like to ask Mr. Rix whether cases which were regarded as cases of normal occlusion ever had abnormal habits.

Mr. R. E. RIX, in replying to the discussion, said that he was grateful to Mr. Ballard and Mr. Gwynne-Evans for questioning whether some of the behaviour which he had described should be called suckling behaviour. That was a point which he would have to watch. He must admit that, in the early years of a child's life, he sometimes found it difficult to decide whether it was something more marked, as Mr. Ballard suggested.

Mr. Ballard had touched on the American idea that some of the suckling behaviours (if he might continue to call them so for the moment) were associated with a lack of normal breast-feeding. He agreed with Mr. Ballard that that was incorrect and that there was no association one way or the other.

Both Mr. Ballard and Mr. Hovell had asked him whether he had related the degree of excursion of the mandible during swallowing to the free-way space. He had not done so specifically, but he thought that that was where an association would be found. Where the free-way space was excessive, in postural prenormal occlusion cases for instance, there was a marked opening of the mandible in swallowing. He thought he had noticed that, after he had improved by treatment the position of

upper and lower incisors which had been dispersed, the child's excursion had decreased, but he had not observed a sufficient number of such cases to make any pronouncement upon the subject.

Mr. Ballard had referred to the lower lip and tongue contact and had mentioned that sometimes, when one pulled the lower lip away from the tongue, the tongue receded into the mouth. He had an impression that, somewhere or other in the nervous control of the position of the tongue and the lips, there was some strange urge which kept these two organs in contact with one another.

Mr. Gwynne-Evans' differentiation between somatic and visceral behaviour was very interesting. He knew that Mr. Gwynne-Evans had just published some work on that, and he hoped to look into it closely.

Mr. Hovell had asked how he measured the degree of opening. It was easy where there was retroclination of the incisors. One merely made a pencil mark on the lower incisors or lower gum, marking the extent of the overlap of the upper incisors when the arches were in occlusion. Then one asked the patient to swallow and by separating the lips one was similarly able to mark in pencil the lessened degree of overlap. The patient did not separate his jaws sufficiently to eliminate the overlap entirely. It usually decreased to somewhere within 1 or 2 mms. of the lower incisal edge. It was more difficult to measure with accuracy, when incisors were dispersed. He then marked first of all, the degree of overlap in the occlusal position. He could measure from that point to the lower incisal edge. That gave him, perhaps, three quarters of the amount of the excursion of the mandible. The excursion was sufficient, however, to separate incisal edges; that was often a matter of 2 or 3 mm., and after a time one became very good at guessing. He used calipers to help this approximation. He thought that the figures which he had given were reasonably right. There might be $\frac{1}{2}$ mm. one way or the other in them, but, when one considered that of 7 mm. excursion one might perhaps mark 4 or 5 mm. accurately on the lower incisors, there remained only 2 or 3 mm. afterwards for personal judgement.

In reply to Mr. Hovell, he would say that he did not think that what Mr. Hovell called an incompetent lip posture was invariably present in Class II, Division 1, cases.

Mr. Hovell, interposing, said he agreed that it was not invariably present, but he thought it was present in a much greater number of cases than the paper led one to believe.

Mr. Rix said that Mr. Hovell had also asked whether the teeth were always apart, during swallowing, in double retroclination, and his reply to that was that they were during childhood.

Mr. Gray, in referring to the question of treatment, had said that he used something to prevent the tongue from getting forwards against the backs of the upper incisors and also held the lower lip away from the lower incisors. He agreed that that removed the immediate influence of the tongue and the lower lip from the teeth. The monobloc also was useful for screening the incisors from these adverse strains.

It was very difficult to persuade a child with a teeth-apart swallow to put his teeth together when he swallowed, and he did not think that one could do much about it, certainly not until children reached the age of 13, 14 or 15, when they could begin to apply themselves to their own problems. One could then explain to them in detail what they should do. He thought there was no doubt that some children entirely overcame or grew out of the teeth-apart swallow. One case of double retroclination with a corrected Class II occlusion he had been watching for a long time and hoping that the teeth-apart behaviour during swallowing would go. Recently

he thought that he would photograph the child again for the purpose of the present paper. When the child arrived he found that she was swallowing quite normally.

He had occasionally suggested the use of chewing gum (he did not think one ought to put very much faith in that sort of thing), telling the child to make sure that she trapped the gum between the teeth every time she swallowed. He remembered one case in which gum had been suggested and the child's teeth had come together during swallowing, but he would not like to say that that was the cause.

With regard to Mr. Tulley's question whether early upper respiratory troubles fostered the teeth-apart swallow, he did not think that they initiated it, but he was inclined to think that they lessened the likelihood of it ever being improved. That was why he thought it was worth while to have a naso-pharynx as clear and as healthy as one could have it.

Mr. Chapman had asked whether there were any cases at all without some strange muscular behaviour. In the first four or five models which he had shown, the children had been normal in their behaviour, and he would guarantee that if anyone present asked the next child he saw about 7 years of age, with a nice dentition, to swallow it would do so in the proper way, with no separation of the teeth.

Comparative Anatomy of Tooth-Movement During Growth of the Jaws

J. C. Brash, *M.C.*, M.A., M.D., D.S.C., F.R.C.S.(Ed)., F.R.S.E.

Professor of Anatomy, University of Edinburgh

Twenty-three years ago your Society did me the great honour of electing me to honorary membership. In that year of 1929, when the society celebrated its coming-of-age, Mr. George Northcroft was President for the second time; and I am proud to recall, as recorded in your Minutes, that it was on his Presidential motion that I was elected. I think I may assume that this signal honour, which I confess gave me great satisfaction, arose out of the part I was privileged to play with Mr. Northcroft himself and others, through the medium of the 1924 Dental Board Lectures, in initiating intensive discussion of the problems of the Growth of the Jaws that are now recognized to lie at the basis of Orthodontics. These circumstances, Mr. President, are naturally in my mind on this occasion, so that for me it is a peculiar pleasure to express my very deep appreciation of the further honour you have done me by your invitation to deliver a Northcroft Memorial Lecture.

I am well aware how right it is that you should thus annually remember with gratitude the debt that you owe to one who, with the enthusiastic co-operation of Mr. Badcock, your first President, was the founder of your Society and, as your Transactions show, the inspiration of many of your important discussions. It is not for me to recall in detail at this time these and other services rendered by George Northcroft to the specialty that he loved so well—that was admirably done in the Notice which appeared in the forefront of your 1942/43 Transactions, by Mr. Badcock himself when this Memorial Lecture was inaugurated in 1947 and by successive Presidents in their introductory remarks—but I do wish to say that my pride and pleasure at taking a place in the roll of Northcroft Memorial Lecturers is greatly enhanced by my memory of George Northcroft's gracious personality and of the stimulus to continued interest in the problems of the growth of the jaws which came to me from my first association with him nearly thirty years ago.

Looking back over contributions to the basic problems of Orthodontics during these years, I have been struck by one development that seems to me to be of fundamental importance. Since I may assume that the basic technique of the practice of Orthodontics is the moving of the teeth in the jaws, *secundum artem*, I have always thought that the basic knowledge required for success must be knowledge of the natural movement of the teeth in the jaws during the growing period—in what directions and to what extent they do move in addition to the obvious vertical movement of eruption.

In my original studies of the mode of growth of the mandible (1924, 1929) I may recall that I had indeed found that the key

The Sixth Northcroft Memorial Lecture presented to the meeting on 10th November.

to the old problem of the change in form and dimensions of the ramus, and in particular the manner in which the erupting molars appear in front of its anterior border, is the proximal movement of the teeth themselves in the alveolar bone as they move also vertically in eruption, with continued movement both upward and forward after eruption in the ordinary sense is complete.

Apart from the fact that this forward movement of the teeth is evidenced by the distribution of new bone in the alveoli of the jaws of pigs treated by the madder technique, as described in my paper on "The Growth of the Alveolar Bone" in the 1926 Transactions, the movement was corroborated and its extent could be judged by the superimposition of outlines of mandibles on the basis of observed increments of bone at several sites—alveolar border, coronoid process, condyle and posterior border of ramus, and the growing edge of the mandibular foramen.

I believe that orthodontic literature in at least the last twenty years does show a progressive acceptance of the idea and of the evidence that the human cheek-teeth actually move forward in the jaw. It is not my intention to survey the development of clinical opinion on this question, and I will content myself with recalling what Mr. Northcroft himself said about it and with quoting the latest pronouncements of Dr. Sheldon Friel who has been a consistent advocate of this basic phenomenon and has done much to show how important it is in the human jaws for the development of correct occlusion.

So far as I can ascertain, Mr. Northcroft did not, in any of his numerous contributions to the Transactions of this Society, specifically discuss the question of forward movement of the teeth in the alveolar bone; but he did on one occasion indicate clearly that he had come to believe that this occurred as a normal growth-process. This he did in opening the Discussion of Mr. Wilson Charles' paper on "The Development of the Mandible" in 1934. Mr. Charles, referring to my own paper on "The Growth of the Alveolar Bone," had remarked that there did not "appear to be any logical reason for doubting that the madder specimens do indicate bone growth with a fair degree of accuracy" and, more specifically, that my conclusions were important to his own investigation "because they show by another process of reasoning that the mandible does not grow by deposition of bone at the posterior border with mass absorption in front of the condyle and coronoid, but that the teeth move forward and upward relative to the main line of growth."

Mr. Northcroft is reported then to have commented that he was "very glad to hear Mr. Charles say that it was right to assume that there was a definite movement forward of the teeth through the growing bone; that was an idea that he had himself held for some time." In my turn I think I may say that I am very glad to be able to claim Mr. Northcroft as a convert to the "idea" that I believe expresses an important basic process in the growth of mammalian jaws.

Dr. Sheldon Friel's pronouncements on this question have been frequent and even emphatic. I note that in the Discussion of a paper by Mr. A. A. Wilkinson (1942) he mentioned several sources of evidence, including his own observations on the changing position of the maxillary teeth relative to the palatal rugae and "the greater difficulty of moving teeth distally with an orthodontic appliance than moving them medially. He always found it exceedingly difficult to move teeth distally with an orthodontic appliance," thus indicating the importance of knowledge for practice to which I have already referred. And in two of his papers on "Migrations of Teeth" (1945, 1949) Dr. Friel has marshalled the evidence for forward movement of the cheek-teeth from the experimental and clinical points of view. He has thus summarized his

opinion in the statements " The evidence of normal growth and the development of occlusion show that all teeth are moving forwards. No evidence is available that teeth move backwards " (1945); and " It is a forward movement of the anterior teeth which makes room for the successive molars and . . . . . the major part of that movement takes place after the teeth have erupted " (1949). Further references to the same phenomenon are to be found in Dr. Friel's 1951 Northcroft Memorial Lecture which I have had the privilege of seeing in typescript.

Fortified by the impression that the idea of forward movement of the teeth in the bone during the growth of the jaws has become, or is in process of becoming, generally acceptable, it occurred to me, when I received your invitation to give this Northcroft Memorial Lecture, that it might be useful if I were to expand and summarize observations I had already made on those special cases in the Comparative Dental Anatomy of the Mammalia in which forward movement of the cheek-teeth has become so accentuated and so obvious as to produce a veritable ' horizontal succession.'

I have therefore entitled this Lecture " Comparative Anatomy of Tooth-Movement during Growth of the Jaws "; and my quite simple object is to demonstrate that the ' horizontal succession ' of the cheek-teeth exhibited by certain animals is but a highly specialized evolutionary development of the fundamental phenomenon of forward movement of the teeth in the alveolar bone during the growth of mammalian jaws. Some of the evidence has already been published incidentally, and this Lecture is to that extent in the nature of a Review of the evidence from a particular point of view.

Let me first remind you of the basic evidence of the mode of growth of the mandible—which applies also, *mutatis mutandis*, to the maxilla—from which the hypothesis of forward movement, now raised I venture to suggest to the status of theory, was originally derived.

(The lecturer then showed lantern slides illustrating the mode of growth of the mandible and demonstrating the evidence that the cheek-teeth move forward in the alveolar bone during the growth-period. These slides were taken from the following publications: Brash (1929), Figs. 1, 2, 3; (1934), Figs. 16, 17, 18, 19, 20: Inkster (1951), Fig. 172: Scott (1951), Figs. 4, 12.)

The evidence thus obtained, corroborating the primary evidence from the distribution of new bone in the alveoli of the jaws of pigs, suggested an investigation of the state of the alveoli in the Manatee, long known to exhibit an apparently continuous ' horizontal succession ' of the molars. Examination of the alveolar walls disclosed indubitable evidence that the interalveolar septa in the Manatee are in a constant state of growth-movement forwards as indicated by bone-deposition on their proximal and bone-absorption on their distal surfaces. This evidence is readily appreciated by the naked-eye, and it was illustrated by a photograph (Fig. 22) in my 1926 paper. The conclusion then reached was that the growth-movement of the septa is responsible for the continuous forward movement of the teeth. The wear of the teeth increases progressively from behind forwards; the roots of the molars begin to be absorbed as they approach the front of the jaw; the leading tooth is cast off in due course; and the continuous succession is assured by the persistence of the dental lamina and the constant presence of a developing tooth in the ' alveolar bulb.'

From time to time I have made similar observations on the jaws of the Elephant (Brash, 1950) and have now added observations on the same phenomena in the jaws of the Dugong and the Wart-hog.

(The lecturer then illustrated his thesis of the responsibility of alveolar bone-growth for the forward movement of the

teeth in the four animals by a series of forty lantern slides; of these, sixteen have been selected as key-illustrations in relation to the following notes.)

MANATEE.

The jaws of the two species (*Manatus americanus and senegalensis*) exhibit the same features.

Figure 1 shows that the wear of the molars increases from behind forwards, the shallow anterior socket from which a tooth has dropped out, the erupting tooth at the distal end of the series, and the persistent ' alveolar bulb ' projecting into the upper part of the elongated mandibular foramen. The porous, or fenestrated, medial wall of the alveolar trough, within which the interalveolar septa and the teeth move forwards, also is characteristic.

The radiograph of the same half-mandible (Fig. 2) demonstrates the increasing obliquity of the roots of the molars as they move forwards, the erupting tooth in its socket and the presence of two developing teeth behind it in the ' alveolar bulb'.

In Fig. 3 a longitudinal vertical section through the alveoli of a mandible is viewed obliquely from behind to show the characteristic pitting of the distal surfaces of the interalveolar septa due to absorption of the bone.

Figure 4 is the same section viewed obliquely from the front to demonstrate the equally characteristic ridged appearance of the proximal surfaces of the septa due to bone-deposition. The abrupt proximal

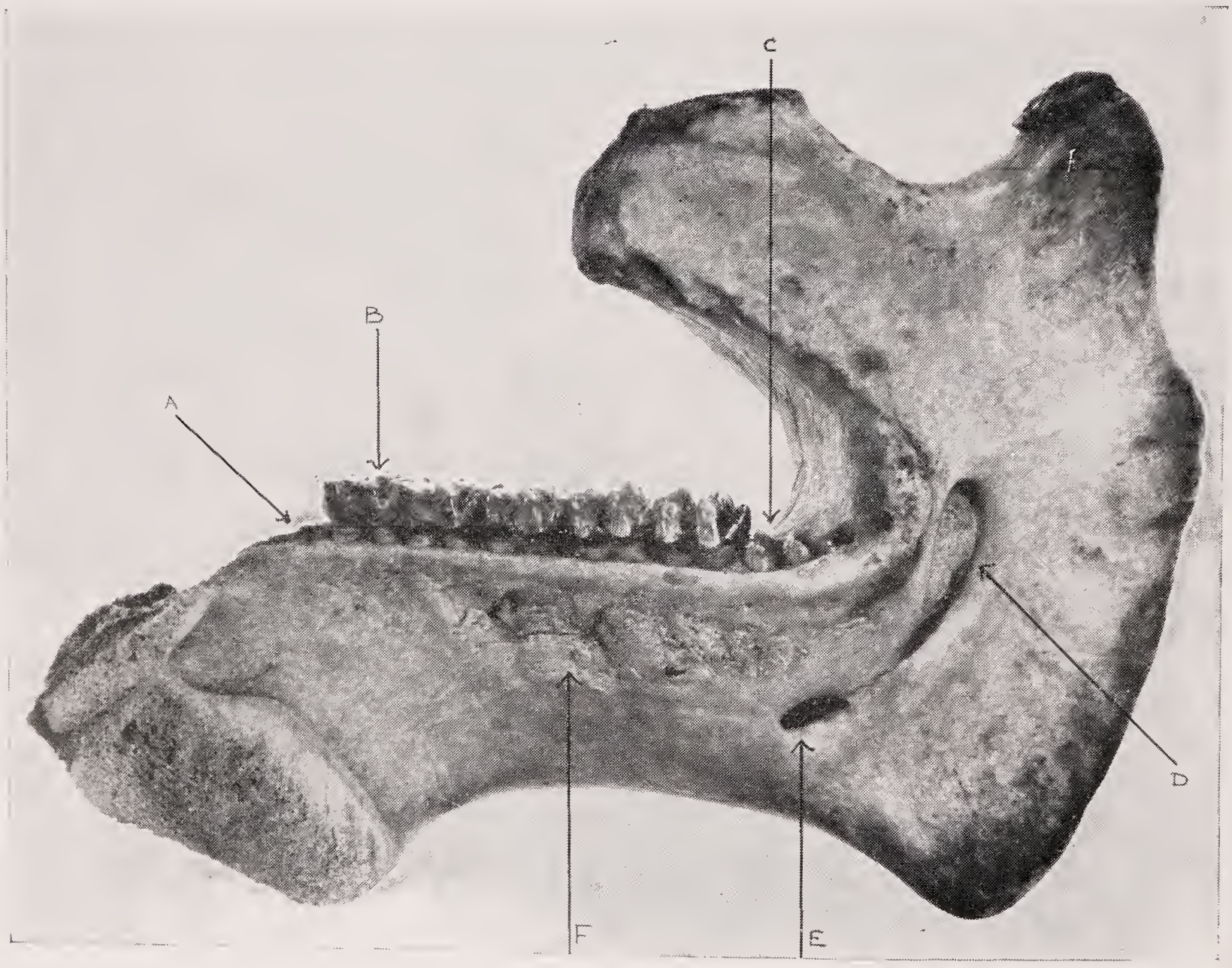

FIGURE 1.

Senegal Manatee. Medial aspect of right half-mandible, x 1/2
(a) Empty socket. (b) Worn proximal teeth. (c) Erupting tooth. (d) Alveolar bulb. (e) Mandibular foramen (f) Porous alveolar bone.

edge of the advancing new bone is visible in several of the alveoli (Cf. Figure 5).

Figure 5 shows the distal and proximal walls of a mandibular alveolus which has been divided by a transverse vertical section. The distal wall (proximal surface of septum) shows the characteristic appearance of bone-growth with an abrupt advancing edge—in the Senegalese Manatee the ridges are more obviously transverse (Brash, 1926, Figure 22); the proximal wall (distal surface of septum) shows the equally characteristic pitted appearance of bone-absorption.

DUGONG.

There is one species of Dugong (*Halicore dugong*), and there is some doubt about the number of its molar teeth which may perhaps vary from five to eight. In the young mandible illustrated (Figure 6) there is evidence of six, and this number has been adopted for identification of the teeth in the mature mandible (Figure 7).

In contrast to the Manatee, the Dugong has a limited number of molars but (1) they are not all in use at the same time, the proximal members being worn down and removed by absorption of root and filling-up of socket before the distal come into place; (2) they increase in size proximo-distally, the last molar (sixth) being specially large with some resemblance to a 'compound tooth'; (3) with the loss

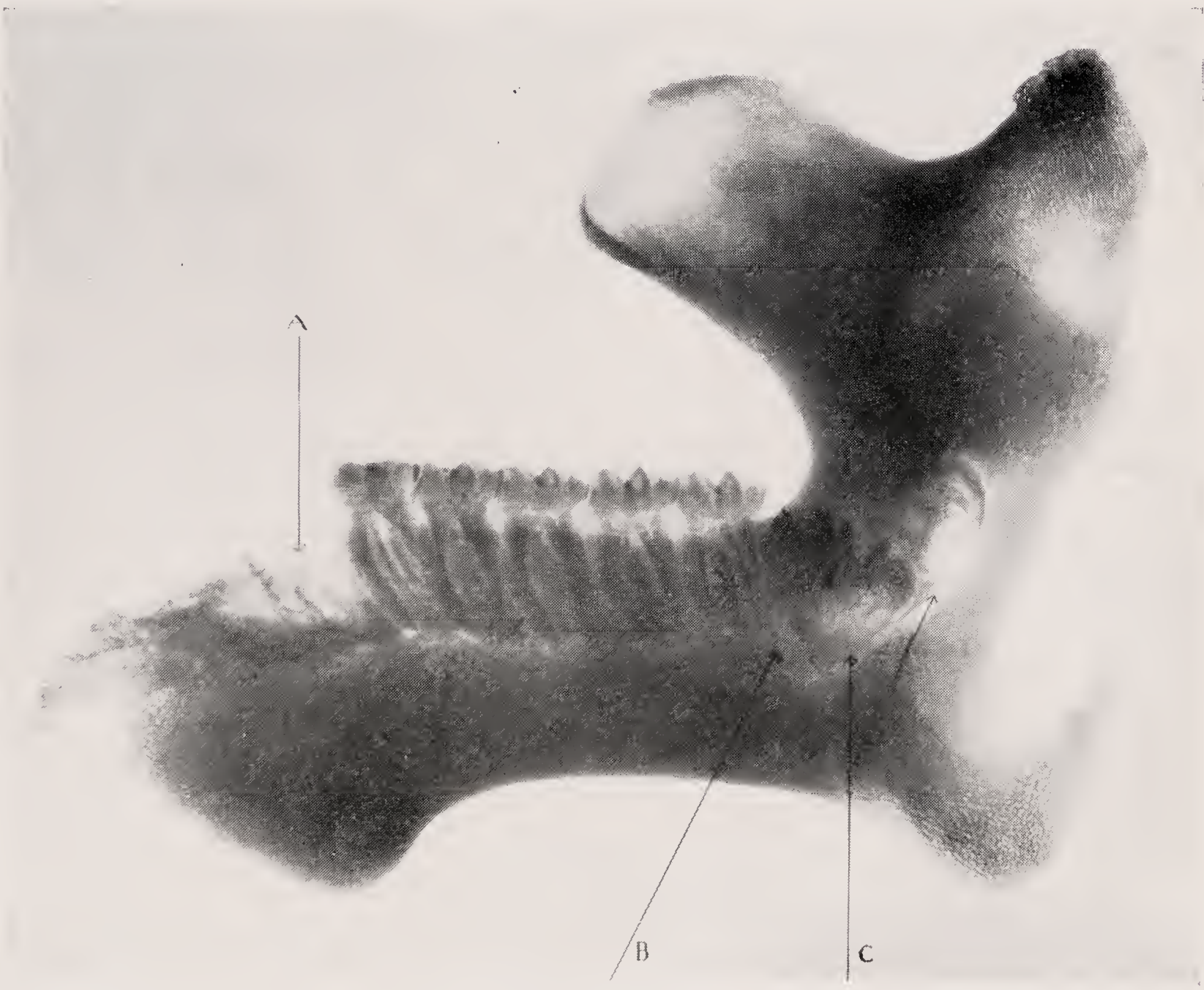

FIGURE 2.

Senegal Manatee. Radiograph of the same half-mandible, x 1/2

(a) Empty socket. (b) Erupting tooth. (c) Two developing teeth in alveolar bulb.

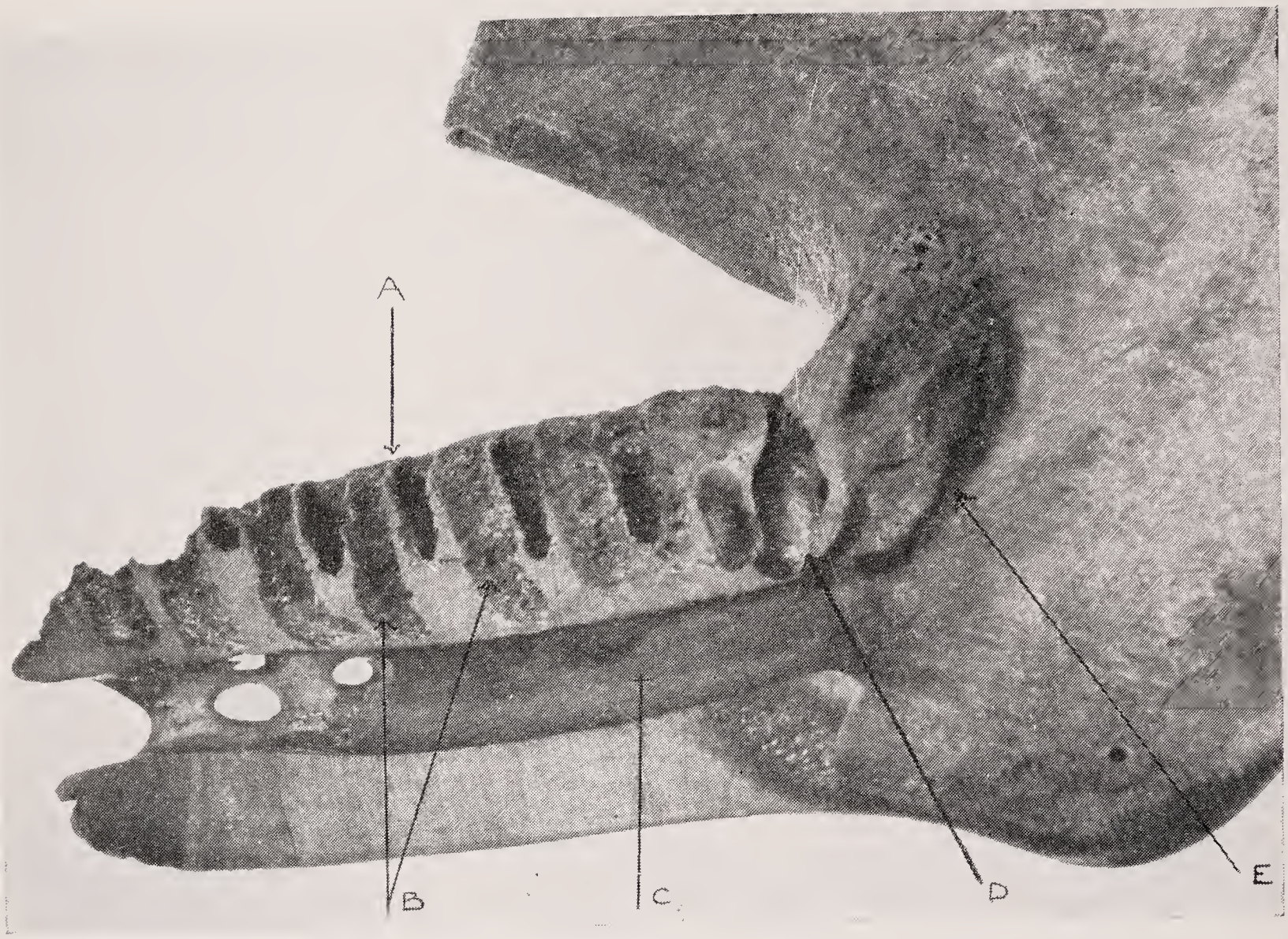

FIGURE 3.

American Manatee. Section of right half-mandible photographed obliquely from behind, 2/3
(a) Interalveolar septum (b) Bone absorption. (c) Mandibular canal. (d) Socket of erupting tooth (e) Alveolar bulb.

of the proximal and the forward movement of the distal molars, the series is ultimately reduced to not more than two.

The Dugong also thus exhibits the phenomenon of ' horizontal succession ' through forward movement of the molars but applied to a determinate number of teeth, in contrast to the continuous succession of the Manatee. In all these respects, including the increasing size of the molars, the Wart-hog and the Elephant resemble the Dugong rather than the Manatee.

The radiograph in Figure 6 shows the arrangement of the molar teeth in the mandible of a young Dugong. The partly-filled socket of M 1 shows that the remnant of this tooth had fallen out, the root of M 2 is undergoing resorption, the root of M 5 is not fully formed and the rudiment of M 6 is seen in the ' alveolar bulb.'

Figure 7 shows the mandible of an older animal with three molars (4, 5, 6) and the empty, shallow socket of M 3 in front.

The relative size of M 5 and M 6 is better seen in the radiograph of Figure 8, which shows also the partially-filled socket of M 3. It is evident that the molars are teeth of semi-persistent growth. An alveolar bulb is no longer present. One of the non-erupting incisors is seen in the expanded symphysial region of the mandible. The sockets of these vestigial teeth are seen also in Figure 6.

The appearance of the interalveolar septa in Figure 9 should be compared with the two views of the septa in the Manatee's mandible in Figures 3 and 4. The distribution of bone-deposition and bone-absorption, readily appreciated by in-

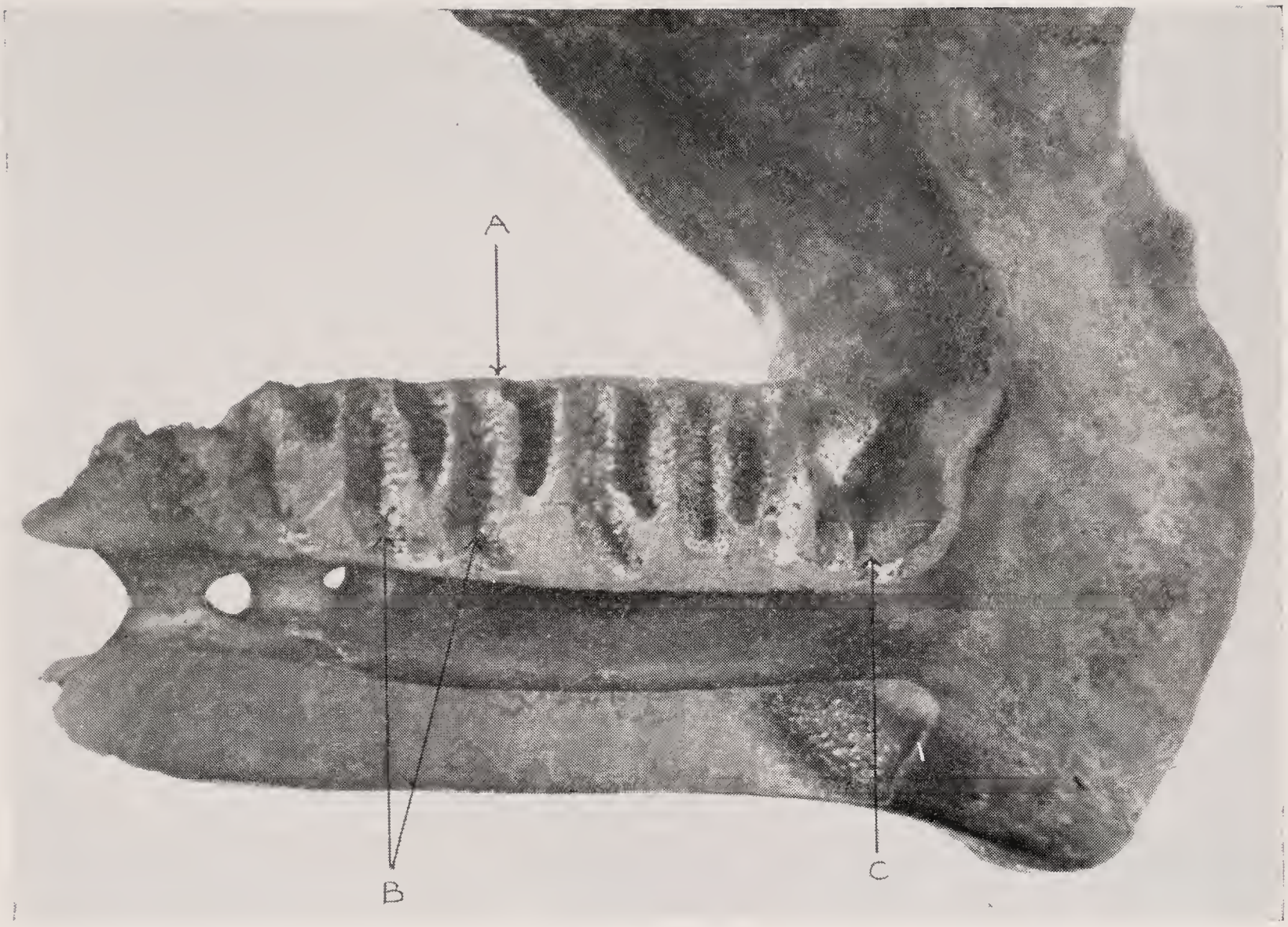

FIGURE 4.

American Manatee. The same section of right half-mandible photographed obliquely from the front, x 2/3
(a) Interalveolar septum. (b) Advancing edges of new bone. (c) Socket of erupting tooth

spection of the actual specimen, is not so easily observed in the photograph. But it indicates that the septa and the teeth are still moving forward, though at a much slower rate than in the case of the Manatee.

WART-HOG.

There is some doubt about the determination of the species to which skulls of the wart-hog belong (Middleton Shaw, 1939); but the two skulls I have studied appear to be specimens of *Phacochoerus africanus*. The younger of these two is more fully illustrated as it shows the essential points to be demonstrated.

The Wart-hog exhibits in a very striking manner the loss of the anterior cheek-teeth before the last molar is erupted. That molar (M 3) is itself a very large, multiple and complex tooth of semi-persistent growth equal in proximo-distal extent to " the third and fourth premolars and the first and second true molars (the whole number of other teeth of the molar series possessed by the animal) together" (Tomes, 1898). It is said that Pm 3, M 1 and M 2 are shed before or during the eruption of M 3, so that there is a stage when the cheek-teeth are reduced to Pm 4 and M 3 (Figs. 10, 11) and ultimately to M 3 only (Figure 13).

The radiograph in Figure 10 and the photograph in Figure 11 demonstrate the size and complexity of M 3, the depth of its socket and its situation immediately behind the tooth identified as Pm 4. The closure of the gaps left by the shedding of M 1 and M 2 is itself evidence of the forward movement of M 3. The alveolus of Pm 4 was very shallow (Figure 10) and its root much absorbed; doubtless that tooth was about to be shed. The com-

pound columnar structure of M 3 is well-seen in Figure 11.

Figure 12 shows the ridges of bone on the lateral wall of the alveolus of M 3 that fit into the vertical grooves of that multiple tooth (Cf. Figures 15, 16). Each of these shallow ridges is growing on its proximal surface, with absorption on the distal, a clear indication that the tooth was still moving forward in the bone (Cf. Figure 13) as well as upward by semi-persistent growth before enclosure of the pulps by the formation of roots (Figure 13).

In the mandible radiographed in Figure 13, M 3 was the sole remaining tooth, though a tiny fragment of Pm 4 was attached to the alveolar surface in front of it. It shows a stage in the occlusal wear of the tooth, the enclosure of the pulps by the formation of roots and the shortening of the proximal columns as described and figured in the paper by Middleton Shaw (1939).

ELEPHANT.

The horizontal succession of the molars in elephants has been so long known that it seems remarkable that the details of the alveolar bone-growth associated with the forward movement of the teeth have not attracted notice.

From a number of specimens at different

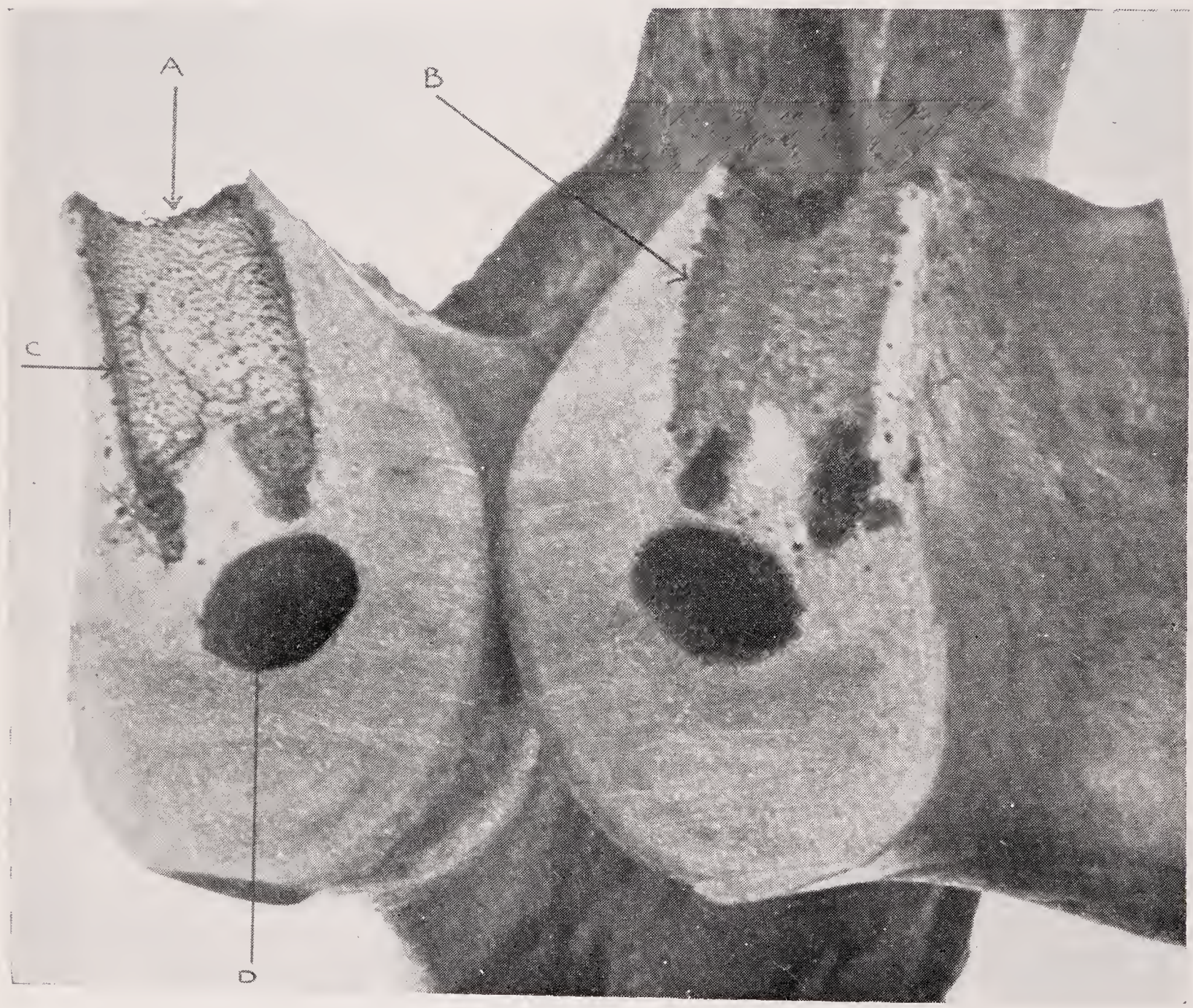

FIGURE 5.

American Manatee. Distal and proximal walls of a mandibular alveolus, x 1 1/3

(a) Bone-deposition on proximal surface of septum (distal wall of alveolus). (b) Bone-absorption on distal surface of septum (proximal wall of alveolus). (c) Advancing edge of new bone. (d) Mandibular canal.

stages of the forward movement of the six compound cheek-teeth, increasing in size from m 1 to M 3, as the jaws grow, the mandible of a young African elephant is selected to illustrate the evidence that the interalveolar septa and the ridges of bone that fit between the plates of the teeth travel forward by proximal deposition and distal absorption.

The third 'milk-molar' (m 3) in Figure 14 shows the usual wear of the occlusal surface and absorption of its proximal 'roots'; only the proximal corner of the first "permanent" molar (M 1) is in occlusion and its distal plates, not fully formed, were still loose in the alveolar cavity. Rudimentary plates of M 2 were present in the 'alveolar bulb.'

These two illustrations of the alveolar sockets of m 3 and M 1 in the African elephant show very clearly the bone-deposition on the proximal and bone-absorption on the distal surfaces of the interalveolar septum and of the ridges that fit into the grooves of the plates of the two teeth and between the separate roots of m 3.

There can be no doubt that they all move forward by this growth-process with the teeth, and that the conformation of the walls of the alveoli is entirely relative to the progressive change in the position of

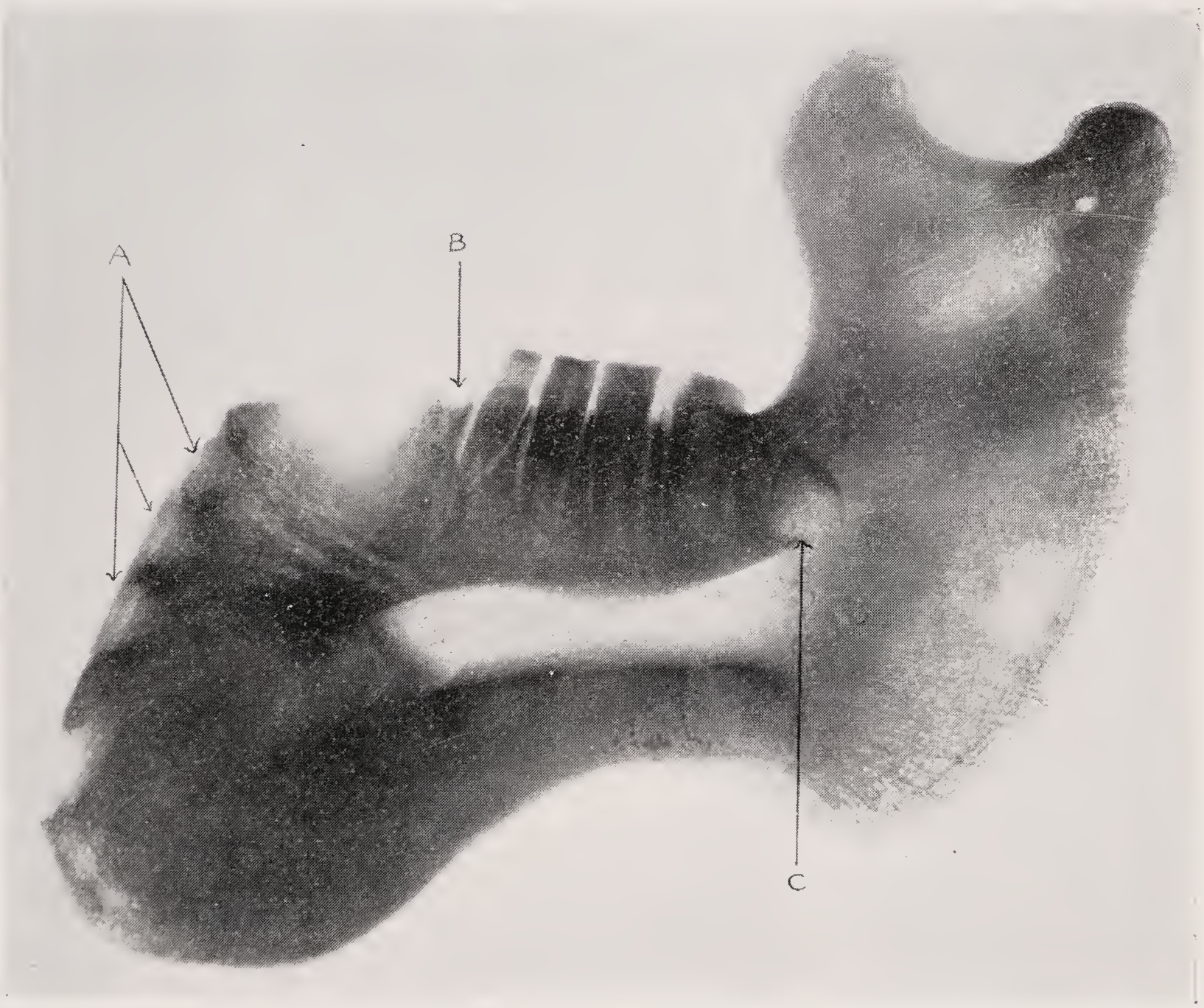

FIGURE 6.

Dugong. Radiograph of right half-mandible of a young animal, x 3/5

(a) Sockets of vestigal incisors. (b) Partly-filled socket of M 1 (c) Developing M 6 in alveolar bulb

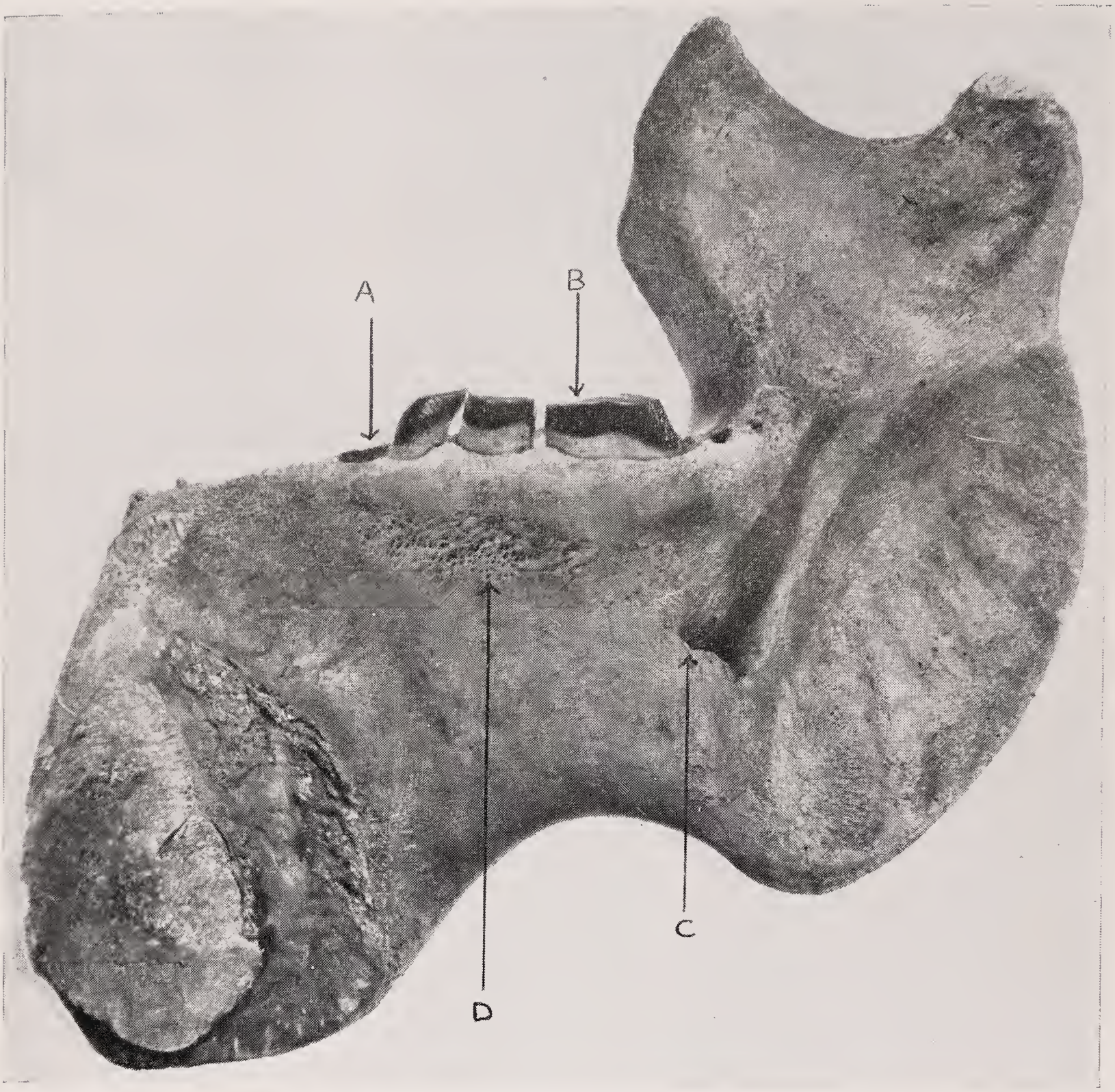

FIGURE 7.

Dugong. Medial aspect of right half-mandible of mature animal, x 3/5

(*a*) *Socket of M* 3 (*b*) *M* 6 (*c*) *Alveolus of M* 6 *in mandibular canal.* (*d*) *Porous alveolar bone*

the teeth.

Having thus demonstrated, I hope to your satisfaction, the indubitable evidence that in the jaws of these four animals the interalveolar septa and the intra-alveolar ridges are in a constant state of reformation by bone-deposition on the proximal and bone-absorption on their distal surfaces, I suggest that the conclusion, arrived at by others on general grounds, that the teeth themselves are moving steadily forward becomes inevitable. The relation of the teeth to the jaws is thus not fixed but entirely relative—a striking and wonderful example of the principle of relativity that applies to all details of skeletal form during the growth-period and particularly to the details of that system of relativity that we call the skull.

So far as I can ascertain, this evolutionary development of forward movement of the cheek-teeth resulting in a veritable ‘ horizontal succession ’ is limited among living Mammalia to the four genera whose

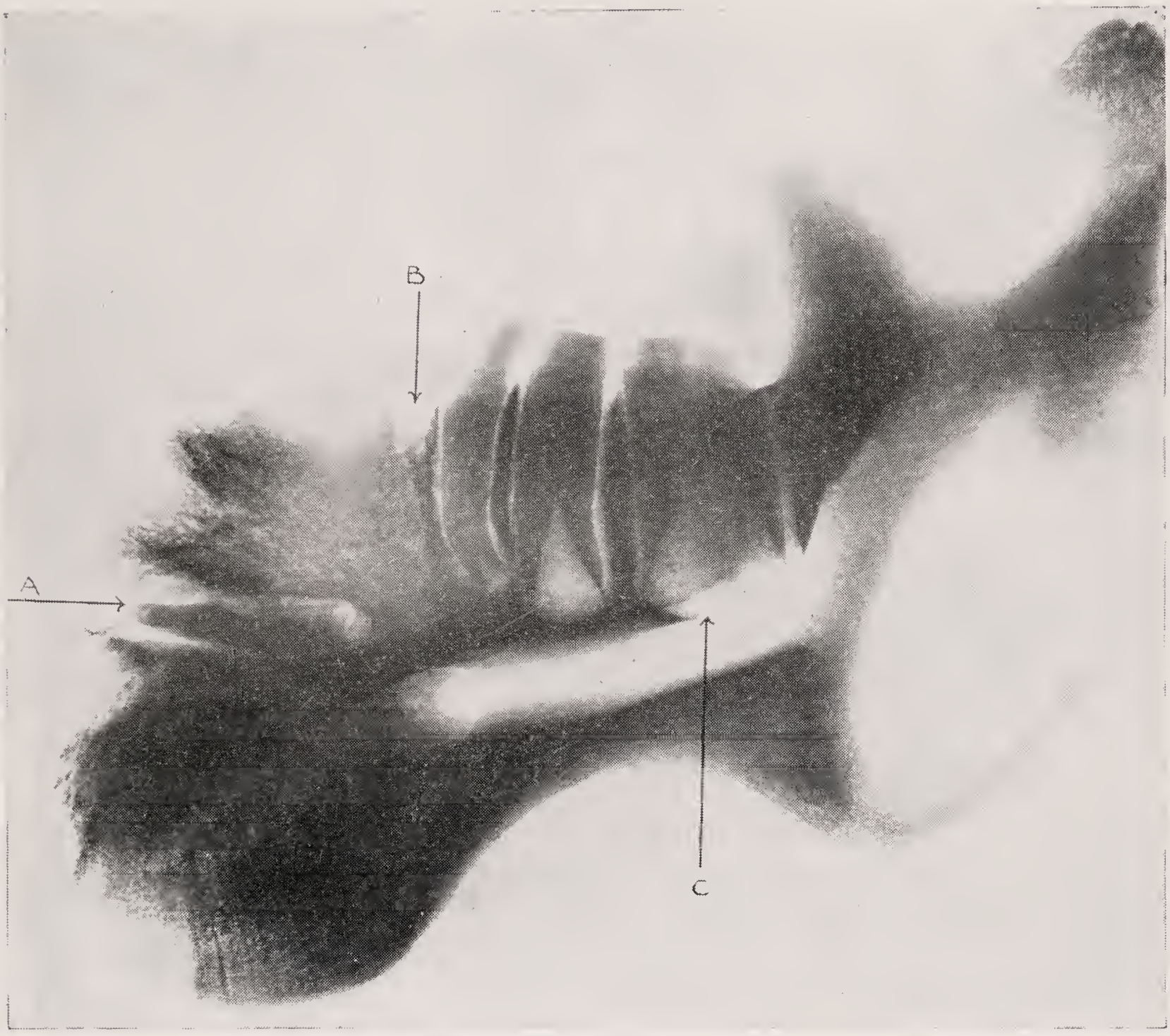

FIGURE 8.

Dugong. Radiograph of the same half-mandible, x 3/5
(*a*) *Vestigal incisor.* (*b*) *Partly-filled socket of M* 3 (*c*) *M* 6

jaws I have illustrated. It is true that there are occasional examples of early wear and normal shedding of proximal cheek-teeth among Ungulates in particular, but this occurs only after the whole series has erupted. The anomalous condition in the Kangaroo (Macropus), to which Dr. C. H. Kemball has directed my attention, may certainly appear to fall into the same category or at least to be a connecting link; but it seems that the ultimate reduction of the cheek-teeth to the last two molars occurs mainly at least after the eruption of the full series.

Although the extreme example of the apparently unending succession of molars in the Manatee remains a biological mystery, there must be some significance, evolutionary and genetic, in the relation of the four animals in the classificatory system. The Wart-hog (Phacochoerus) and the Elephant are Ungulates; and the Order of Sirenia, including the Manatee (Manatus) and Dugong (Halicore), is generally held to have Ungulate affinities. Neither the Sirenia nor the Ungulates (including the Elephants as Subungulata) have clavicles; and it is a very odd circumstance that the Manatee, the Dugong and the Elephant share the reproductive characters of abdominal testes, a single offspring at a birth and a single pair of

pectoral mammae. This, however, constitutes a problem that only a Darwin or a Wood Jones might be capable of solving.

Before mentioning briefly the implications of these observations of continuous forward movement of the cheek-teeth and stating some tentative conclusions, I have a suggestion to make which I hope may commend itself to the Society. It seems to me, at any rate, that this phenomenon, so strikingly developed in the Elephant and the Manatee, is deserving of a place in scientific nomenclature. I propose therefore that the distinction between the great majority of Mammalia with all the cheek-teeth present in the jaws after the eruption of the last molar and thus simultaneously in occlusion and those genera that exhibit the phenomenon of 'horizontal succession' whereby proximal members of the series are worn out and discarded before the distal members erupt, I propose that this distinction be indicated by two new terms of reasonably familiar pattern.

Since all our familiar terms in Comparative Dental Anatomy (e.g., heterodont, diphyodont) are of Greek origin with the same termination, it will be convenient and wise to maintain this terminological tradition. I have, however, taken the precaution to consult a classical friend and through him have received suggestions from others of the most suitable Greek expressions and prefixes to convey the appropriate meanings. Two relatively unfamiliar pairs of compounds have thus been suggested conveying respectively the idea of (1) movement of the teeth and (2)

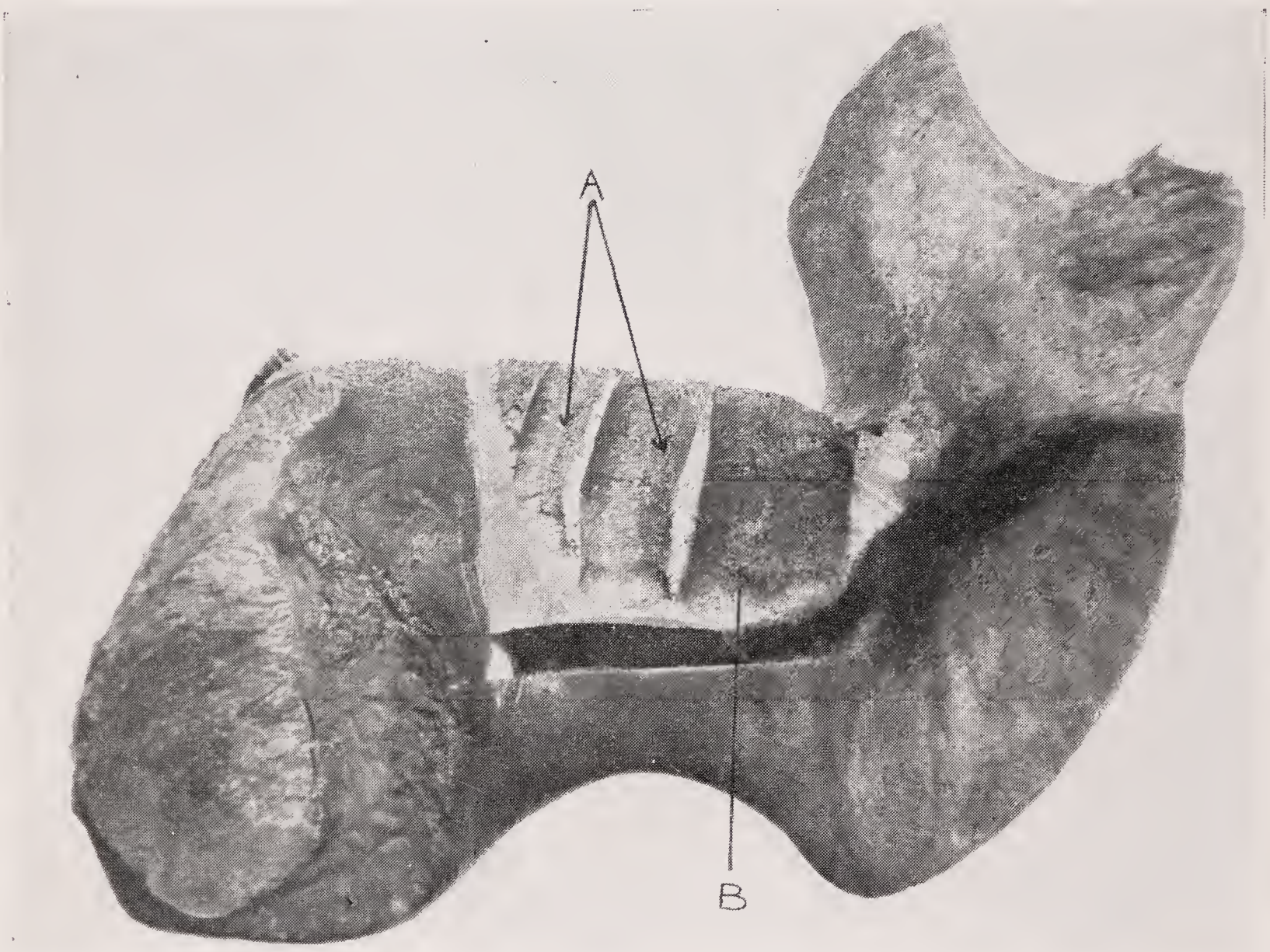

FIGURE 9.

Dugong. Section of the same half-mandible with the teeth removed, x 3/5
(a) Edge of advancing new bone. (b) New bone on proximal surface of intra-alveolar ridge

the time sequence, the positive expression in each case applying to the specialized genera:—' symptotodont ' and ' asymptotodont '; ' epallelodont ' and ' anepallelodont ' or ' synchronodont.' But on the whole it seems better to employ the rather more obvious or even familiar-looking term ' synchronodont ' for the vast majority of Mammalia to mean ' with all cheek-teeth remaining in the jaws after eruption of the last molar and simultaneously in occlusion,' and to use the negative ' asynchronodont ' for the phenomenon shortly described as ' horizontal succession ' without any period of simultaneous occlusion.

What we may therefore term the *asynchronodont* type of dentition, with its characteristic ' horizontal succession ' and asynchronous occlusion of the cheek-teeth in succession proximo-distally, has of course long been known; the facts of the dentitions of the several animals are described and commented upon in all the text-books of Dental Anatomy. The theme of this Lecture is the extension to other genera of the observation, made as long ago as 1926 for the Manatee, that the mechanism of the ' horizontal succession ' is clearly indicated by the evidence of bone deposition and absorption in the alveoli, and consequent emphasis on the proposition that proximal movement of the cheek-teeth is a phenomenon common to all the Mammalia and capable of a high degree of development in special cases.

Charles Tomes, commenting on the classical account of the dentition of the Manatee by Oldfield Thomas and Lydekker (1897) remarked " It seems impossible to resist the conclusion that the whole row of teeth is undergoing a perpetual migration forwards " (1898); and I suppose it is true to say that no one now doubts

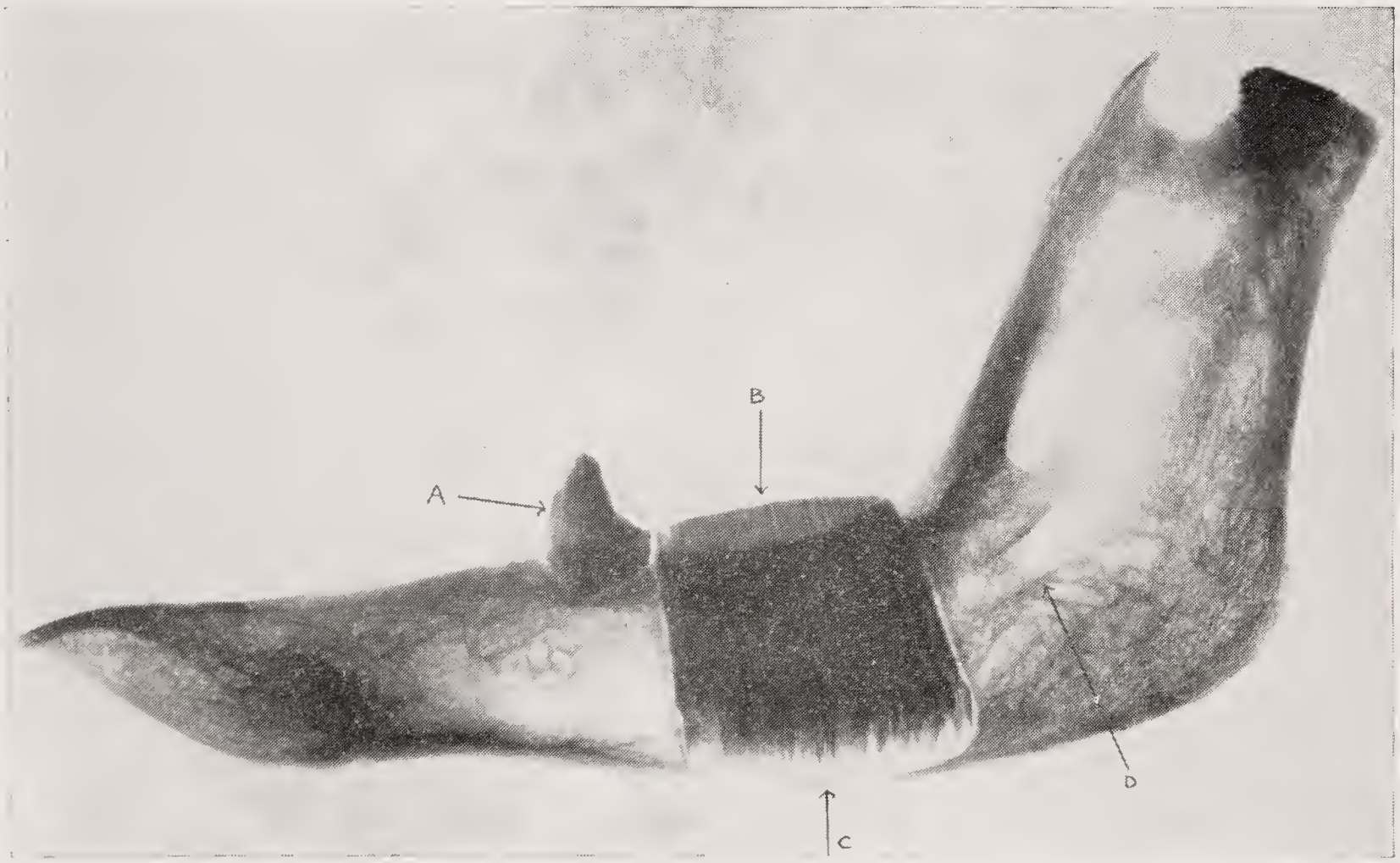

FIGURE 10.

Wart-hog. Radiograph of right half-mandible of a young animal, x 1/2 (*The peculiar form of Pm* 4 *on the right side of this mandible—see also Figure* 11*—was evidently due to asymmetrical use of the jaw on account of injury to the maxillary tusk; the corresponding tooth on the left side of the mandible was worn in the opposite direction to a convex shape.*) (*a*) *Pm* 4 (*b*) *M* 3 (*c*) *Columns of compound M* 3 (*d*) *Mandibular foramen.*

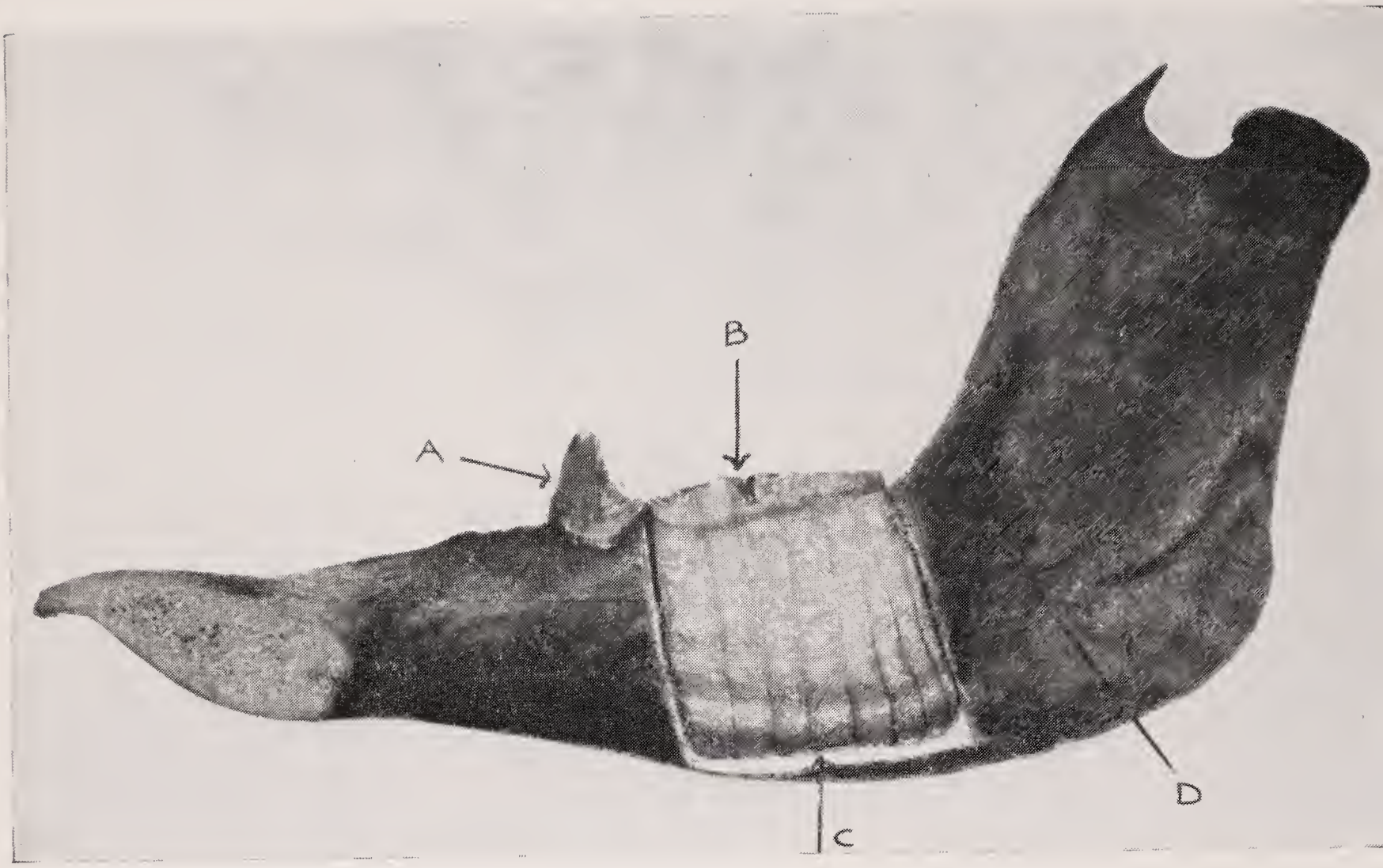

FIGURE 11.

Wart-Hog. Right half-mandible of the same young animal dissected to show M 3 in situ, *x* 1/2 (*a*) *Pm* 4 (*b*) *Worn surface of M* 3 (*c*) *Columns of the compound third molar* (*d*) *Mandibular foramen*

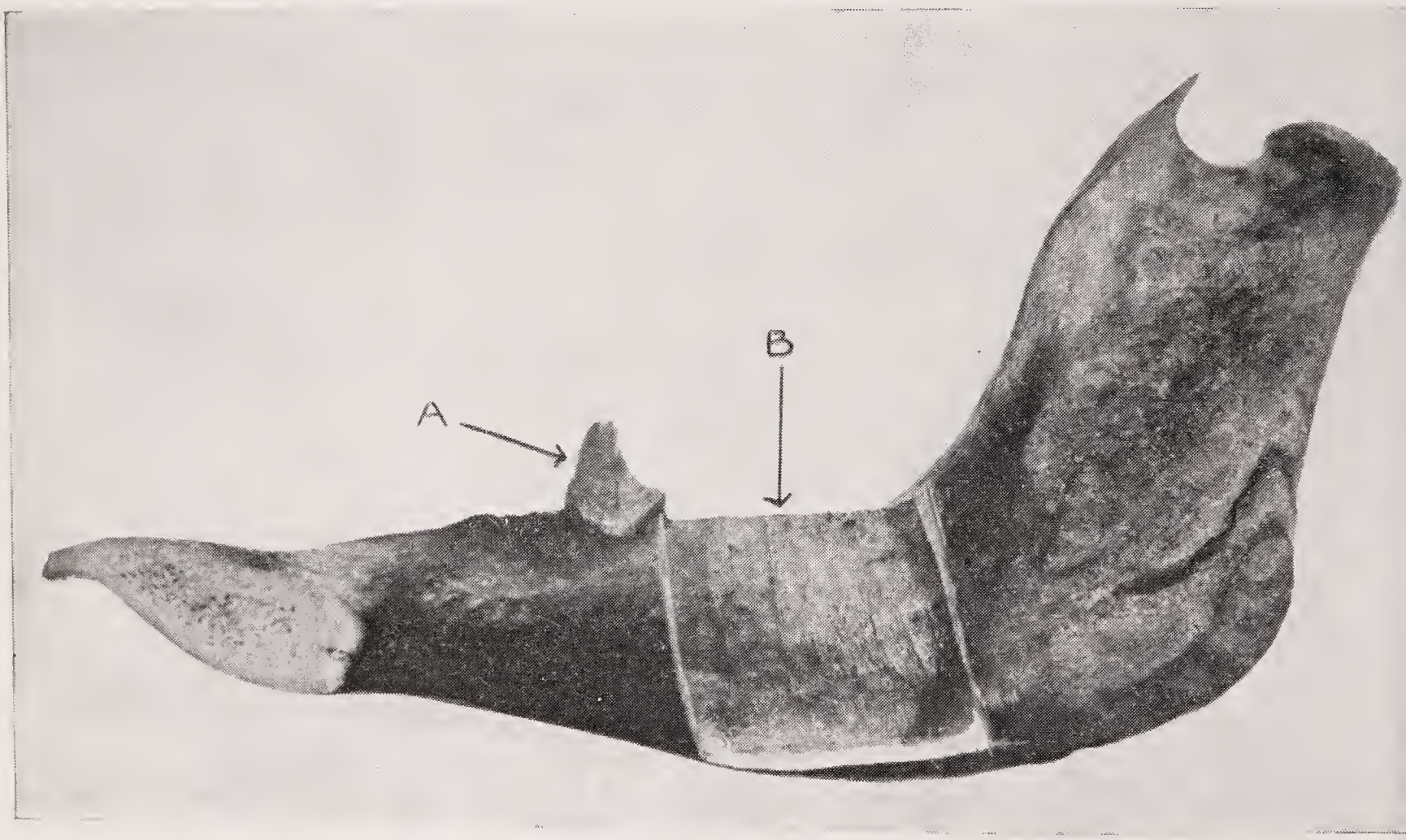

FIGURE 12.

Wart-hog. The same right half-mandible, M 3 *having been removed.* (*a*) *Pm* 4 (*b*) *Alveolus of M* 3 *with intra-alveolar ridges*

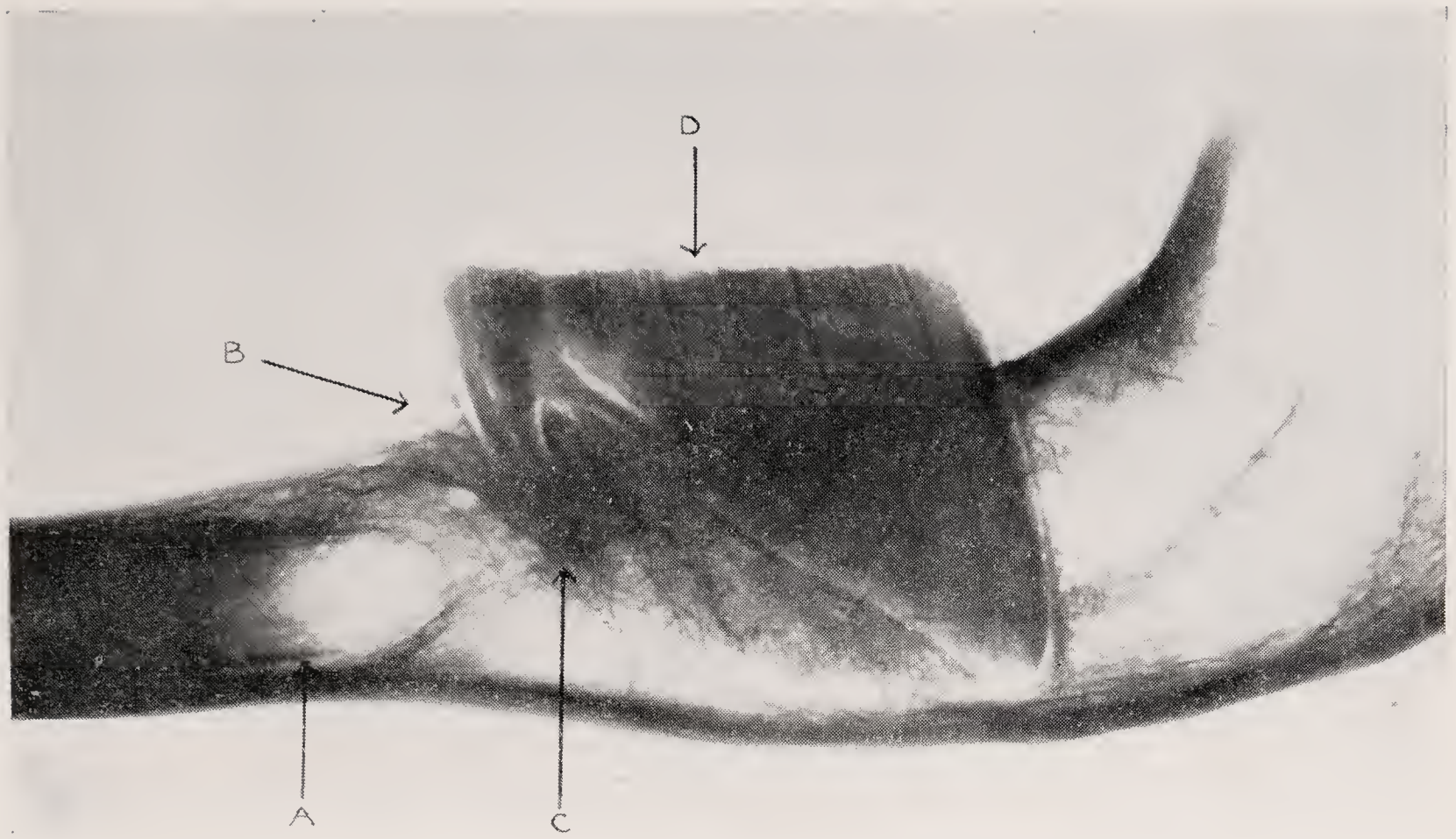

FIGURE 13.

Wart-hog. Radiograph of right half-mandible of older, adult animal, x 3/5
(*a*) *Root of tusk.* (*b*) *Attachment of fragmentary Pm* 4 (*c*) *Proximal root of M* 3 (*d*) *Worn surface of M* 3

FIGURE 14.

African Elephant. Left half-mandible dissected to show m 3 *and M* 1 in situ, *x* 1/4 (*The enamel and cementum of the teeth in this specimen had been cracked in the course of preparation.* (*a*) *Alveolar bulb* (*b*) *Loose plates of M* 1 (*c*) ' *Root* ' *of M* 1 (*d*) *Proximal corner of M* 1 (*e*) *m* 3 (*f*) ' *Roots* ' *of m* 3

that this in fact happens or that the succession of the molars of the elephant also is due to forward movement in the jaws. The additional point is the evidence of associated bone-growth; and I can only repeat my former conclusion that the forward movement is a continuation of the process of eruption and that bone-growth is the effective cause of both.

To summarize, I may put forward the following simple conclusions:—

1. Forward movement of the cheek-teeth in the alveolar bone is a fundamental phenomenon of the growth of the mammalian jaws.
2. The evidence for this is:
   (a) observation of alveolar distribution of new bone in experimental vital staining by madder;
   (b) inference from other studies of the mode of growth of the mandible;
   (c) clinical observation and deduction.
3. Forward movement of the cheek-teeth has been specially developed in the evolution of four mammalian genera to constitute a "horizontal succession" designated as an "asynchronodont dentition."
4. The effective cause of the forward movement of teeth is the growth movement of interalveolar septa and intra-alveolar ridges by proximal deposition and distal absorption of bone.
5. This combination of deposition and absorption is a specialized continuation of the growth of the alveolar bone which is intimately concerned with the eruption of the teeth and probably the effective cause of the later stages of that process.

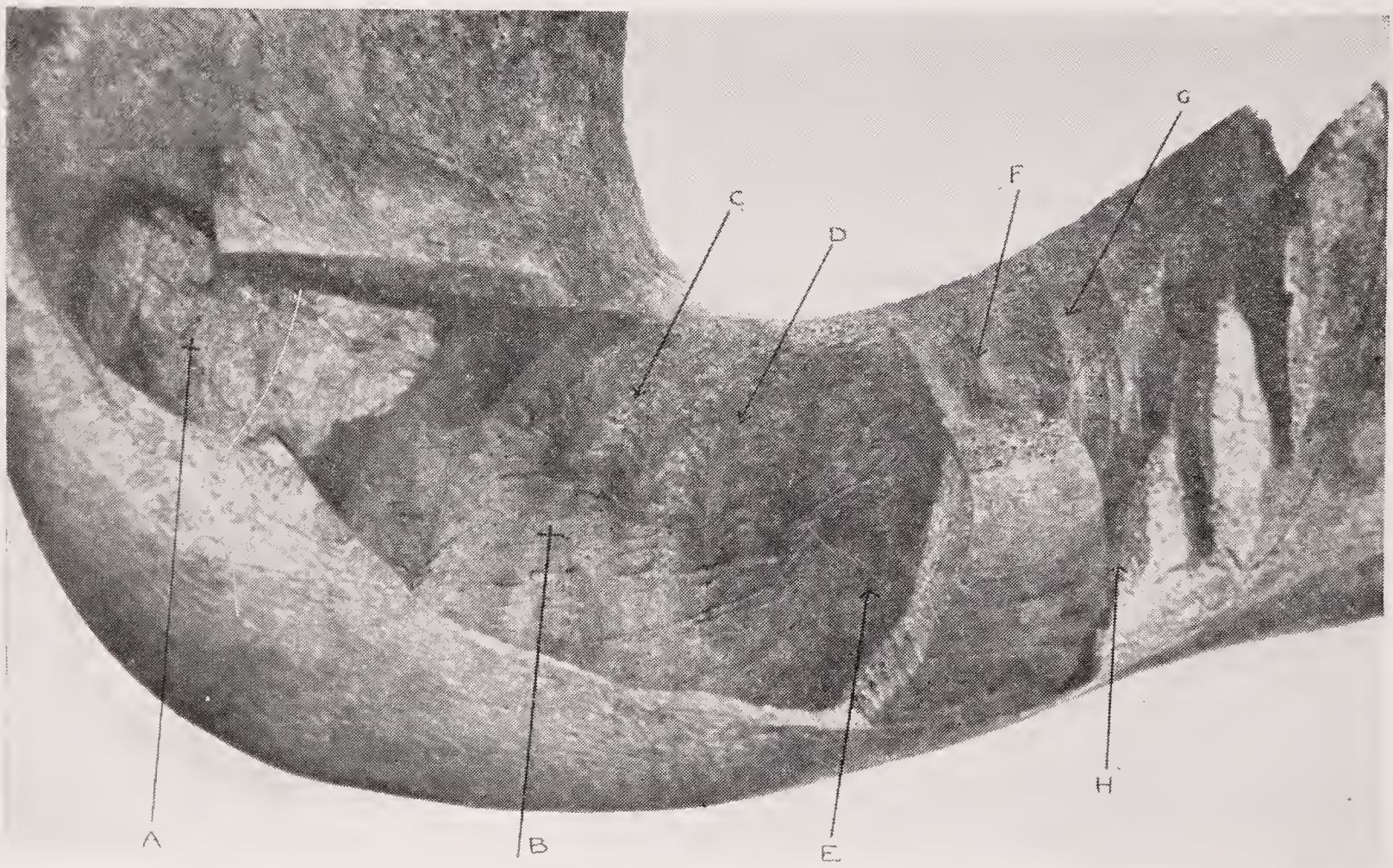

FIGURE 15.

African Elephant. The same left half-mandible with m 3 and M 1 removed, photographed obliquely from behind, x 2/5 (a) Alveolar bulb (b) Cavity for M 1 (c) Bone-absorption (d) Bone-deposition (e) Absorption of distal surface of inter-alveolar septum (f) Edge of advancing absorption (g) New bone on proximal surface of ridge (h) Absorption on proximal wall of socket for distal root of m 3

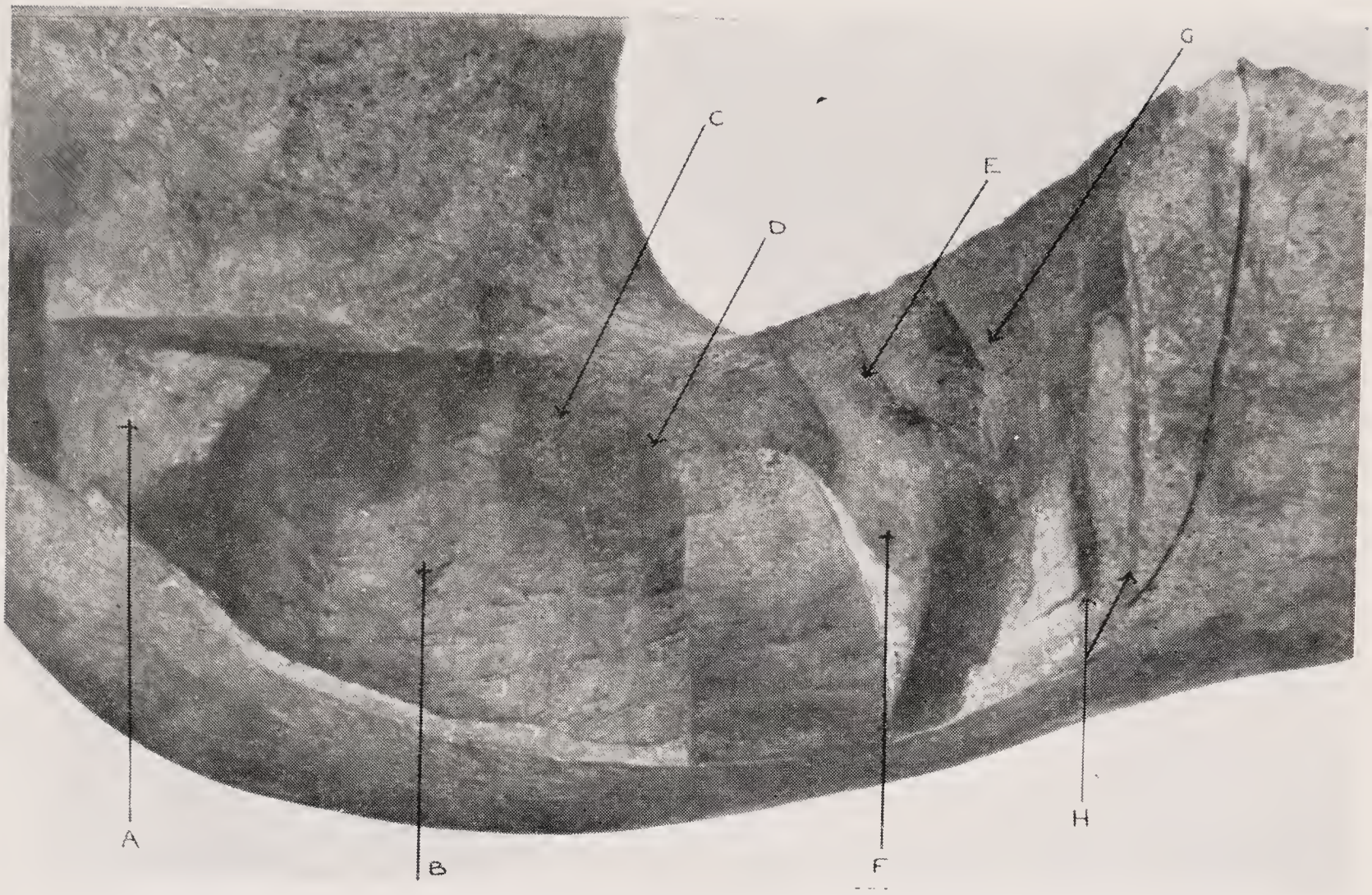

FIGURE 16.

African Elephant. The same left half-mandible with m 3 and M 1 removed, photographed obliquely from the front, x 2/5 (a) Alveolar bulb (b) Cavity for M 1 (c) Bone-absorption (d) Bone-deposition (e) Absorption on distal surface of intra-alveolar ridge (f) Proximal growing surface of interalveolar septum (g) New bone on proximal surface of ridge (h) Sockets for separate roots of M 3

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DISCUSSION

Professor FRIEL said that it was 26 years since he had heard Prof. Brash give his memorable lecture, and he was still as good as ever. His original lecture was a great stimulus to many investigators to collect evidence that would support his hypothesis, and it was collected from cephalometric radiographs, from comparative anatomy and from clinical evidence. All the evidence that had been brought forward had been in his favour; there was none to show that teeth moved in a distal direction. They were always moving medially unless actually driven back by force.

The importance of Prof. Brash's work was to know how the jaws grew and in cases of deficiency or excessive growth to be able to say what area was not growing in a normal manner. The second thing was to understand how teeth might migrate when the arch had been broken, and the direction of migration of teeth after premature extraction.

Illustrating his remarks on the blackboard he said that the first illustration was of a dental arch where there had been an extraction of one first deciduous molar. The result in a great many cases of this type was that the teeth posterior to the extraction moved medially, the teeth anterior to the extraction remained stationary and the teeth on the non-extraction side moved medially so that the centre between the central incisors moved towards the extraction side. It was not that the canine had moved distally, it was just the normal growth forward on an unbroken side and the forward growth of the posterior segment on the broken side.

It was not all quite as simple as that, however, because there were different results with different children who had the same extraction. The difference in the result probably was brought about by a difference in vigorousness of growth of the individual. With a weakling, if that was the correct term to apply, there was a remaining back of the broken side; but in a very vigorous growing child the anterior segment went forward, although not as much as it should do.

The other type of case which was difficult to explain was where the first lower permanent molar and the first and second deciduous molars were extracted at an early age. In this case, the first pre-molar came up close to the canine, and then there was a large diastema between the first and second premolar, and the second premolar erupted with the root leaning forwards. In a normal tooth the apex of the root should go back, but in these cases the root leaned forward, quite differently from the normal methods. If the root had been leaning forward it must be that the whole tooth had been dragged forward. The reason for the large diastema between the first and second pre-molars was probably because the second premolar was developing much later than the first premolar, and it got a thick layer of bone over it which was very slowly absorbed.

Prof. Brash had missed his vocation: he should have been an orthodontist. He had the answers to all the questions. Most of them could teach him how to bend a bit of wire or even to solder, but he was a first-class orthodontist and the best thing we could have done for him was to make him an honorary member of the Society.

Mr. BALLARD said that it was a great pleasure to hear Prof. Brash, particularly as he had based his philosophy of orthodontics on Prof. Brash's Dental Board lectures.

He was worried by the question of forward movement of teeth because, in spite of what Prof. Friel said, he could not apply it to his clinical observations. With very well developed jaws, the cheek teeth remained spaced. Clinically, it was as difficult to bring those teeth forward to fill

those gaps as it was to take a molar back if a tooth behind it was extracted.

Clinically, therefore, it appeared to him that the question of forward drift of the cheek teeth, particularly the sort of forward drift that was seen with the canine mesially inclined crowding the incisors, was related not to that inherent factor within the alveolar bone, but to the tooth substance in relation to the size of the base of the bone. In other words, in the case of a small jaw the developing teeth behind would push the cheek teeth forward, and this crowded the arch in the canine and lateral region. Quite a number of people would probably agree that if one made room behind by extraction it was just as easy to shift a cheek tooth distally as it was to move it forward.

Mr. DIMOCK, reverting to the Author's remarks on elephants, said that he had had a fair amount to do with them and had watched them feeding in their natural state. The food that they had to eat was fantastic, particularly in the dry weather, when nothing was growing and the "wet" proportion of their food was exceedingly dry and tough, and very often sand-laden also.

Wondering how their teeth could endure all that, he had extracted elephant's teeth to see what happened because of wear. Knowing the speed with which this took place, he did not think there was any other possible solution but that the teeth must come forward in the jaw. To see the extracted tooth, to know the numbers they had and to see what they had to eat for about five or six months in the year, he did not think the span of life of an elephant would be sufficient for there to be any other solution than that the teeth came forward as they were worn.

Mr. EMSLIE said that the Lecture had provided a most interesting demonstration of the movement of teeth. Mesial drift did occur, and could be shown by the resting lines in mesio-distal sections of human jaws, but the extent to which it occurred had never been determined. Prof. Brash had suggested that it was a phenomenon of growth, but it appeared to continue throughout the life of the individual. The suggestion had been made that this drift was to compensate for wear of the proximal surfaces of the teeth.

It was an interesting reflection that possibly the number of impacted wisdom teeth that were seen today was caused by lack of proximal wear in the erupted teeth during the earlier life of the individual, due to the less tough modern diet.

On this question of the drift of teeth Prof. Brash did not mention the rat. From histological examination of the jaws, it would appear that the molars of the rat moved distally. Whether this was in any way connected with the continued growth of the rat throughout its whole life, and the fact that its jaws were continually getting larger with a wide diastema between the molars and the incisors, he did not know. But this distal drift of the molars of the rat had been clearly demonstrated by Sicher and other workers.

Mr. BALLARD said that if there was this forward drift, he could not see how the change took place in the front of the mouth. In other words, one could assume that the whole dental alveolar structure was going to move off the mental process, whereas it was known that the normal growth in the human was for the mental process to increase in size in relation to the dental base in the incisor region. Also there was the evidence of Björk and Brodie that alveolar prognathism was reduced during development. In other words, the dental arch appeared to be a little further back in the fully grown.

The President remarked that he, too, was a little puzzled on the same problem.

Mr. WATKIN said they knew that it was all wrong to make an extraction without evidence of crowding. By taking a 6 out of the lower jaw there would be no crowding, but at a very early age there would be a big diastema between the 5 and

the 4. That diastema was probably caused by the 5 erupting later than the 4. The tongue would get between the two, and it pushed the 5 distally into the gap where the 6 had been taken out. Most of them had seen radiographs of the late movement of the 5. Permanent damage was done by taking out the 6 where it should not be taken out, and there was plenty of evidence in the whole jaw to show that the 5 moved distally.

Miss CLINCH, commenting on Mr. Watkin's remarks that the tongue would get into the empty space and push back the second molar, recalled that Prof. Friel said that unless there was a force on the tooth, it would not move back. If there was something pushing it back, then, obviously, it would move back. She did not think this was the explanation of the gap as it was present before the premolars erupted, but certainly it ought to be made clear that though teeth do not drift back they can, of course be moved back by force.

Mr. A. I. MARSTON said that they should be very cautious in applying the drift forward of the molar or the cheek teeth to men. The whole evolutionary trend of men had been for regression of the dental arch. He cited the Heidelberg arch, the mandible with a procumbent chin, and modern man with his exposed trigonum. Nevertheless, the whole dental arcade had moved back, and one had to be very conservative in dealing with jaws, especially of men.

He had himself made a recent observation on the milk tooth-bearing region of the lower jaw, which was in a similar category, and had drawn attention to the fact that if one took the measurement behind the second deciduous molar, and the measurement from that to the incisor teeth, it was the same in the modern infant as in the child of four or five hundred thousand years ago. It was the same in the modern infant as in the Heidelberg adult, and it was actually the same in many modern infants as in many modern adults.

There had been a paper some time ago by the late Dr. Steadman dealing with Tasmanian aboriginals of full size. The measurement to which he had referred was 2·5 cm. from the line joining them, behind the second deciduous molar to the incisor. In the Tasmanian aboriginals of life size, those measurements were the same as in modern man, and as in the modern child also.

While it was only too obvious that there was this forward growth in the species that Prof. Brash had enumerated, one could not say the same of man.

Mr. K. E. PRINGLE, referring to the question of absorption, asked whether it was equal the whole way down the root or was wider at the top. The answer to this might show whether the whole tooth was moving forward or whether it was, so to speak, tilting.

Mr. BREAKSPEAR said that one possible explanation of the distal tilting of lower second premolars in the cases that had been mentioned was that quite a fair proportion of them would seem to be tilted distally in their crypts before they erupted. In X-rays, they could be seen pushing against the distal root of the second deciduous molar. If the first molar was removed, the tooth probably went on developing with the distal tilt, and it might be very badly tilted distally before ever it erupted and before any muscular forces came to work on it.

In a normal case, however, when it was far enough up, the first molar lifted it and guided it up into its proper position; but if the first molar had gone, the tooth went on developing in the wrong direction, which it had first taken a long time before it came anywhere near the surface.

The PRESIDENT said that there were several questions that he wished to put to Prof. Brash. Were they to gather that the forward drift of teeth was taking place in humans throughout life? If so, how did it apply in the case that Mr. Ballard had suggested? Did the fact that the teeth were

of persistent growth have any connection in this relation, and would there be a different cause and effect, for instance, as regards those animals compared with humans? In addition, did the curvature of the roots, which Prof. Brash had illustrated in one instance, have any bearing on the question?

In the example of which Mr. Breakspear had spoken, it was not uncommon to have cases reported that when the first permanent molar had been removed early, the second premolar escaped at the back of that tooth, and this probably contributed at least to some extent to the gap between the first and second premolars.

There being no further contributors to the discussion, Prof. Brash was invited to reply.

Professor BRASH, replying to the discussion, said he did not think that all the teeth in these animals were of persistent growth. Certainly in the manatee, once the tooth had erupted it had proper roots. There was no persistent growth in the roots; they were moving forward. He had always considered, as with the human jaws also, that the backward curvature of the root was itself evidence that the tooth had been moving forward while the root had been growing. There was no doubt of this in the manatee.

As the teeth moved forward and dropped out, naturally something must be happening to the nerves, and there was evidence that each nerve of each tooth was actually growing forward with the tooth in a little groove.

He was not quite sure that he had understood all the points that the speakers had made especially from the clinical point of view; but the point that was made about the evolutionary regression of the human jaws was a very important one.

He did not think there was any evidence that in the human jaw the teeth were continuously moving forward throughout life. They must, however, move forward to some extent for the molars to get into position, but there must be a point at which they ceased to move forward. Possibly some of the clinical difficulties—there was, quite obviously, some difference of opinion upon the clinical point of view—must be definitely related to the evolutionary reduction of the human jaws, since the basic mammalian forward movement of the teeth was still taking place in jaws which simultaneously were regressing from the front. This was one of the sources of all the various conditions that had to be treated and also, possibly, of different observations that might be made in relation to gaps and so forth. He did not want to get out of his depth in these clinical matters.

Regarding elephants, the dental conditions in these remarkable animals themselves must ultimately be related somehow to the ecology of the animals, their habits, mode of life and so forth. As he had already said, it seemed a complete mystery about the manatee, for the dugong had apparently very similar habits. These animals merely floated about in estuarial waters, rooting up vegetable matter, plants and so on. He did not know why one of these related animals—obviously, they were related in many other respects—should develop a regular horizontal succession and the other should go off on the other line with a limited succession of teeth but with the back tooth enlarged. That was a biological problem.

It was news to him that the molars of the rat actually moved backwards, despite his experiments on these animals with bone-staining dyes and extensive collection of their skulls. He had not looked particularly for this kind of evidence, but would now make a point of examining whether there was any bone growth evidence that at any stage in the life of the rat the molars moved back. It would, however, be surprising if this proved to be the case.

He very much appreciated everything that had been said, especially by Prof. Friel, who had even suggested that he ought to have been an orthodontist!

The PRESIDENT, in expressing thanks to Prof. Brash, said that they had had a highly scientific and biologically interesting lecture, which reminded some of them of the times when they knew a good deal about the contents of *Tomes' Comparative Dental Anatomy*.

It was his pleasure to propose a vote of thanks, not only to Prof. Brash but also to Prof. Friel for opening the discussion and for his very ingenious yet simple method of showing why on one side where a tooth had been taken out there was a lack of forward growth.

It was extremely gracious of Prof. Brash to have given up two days to come from Edinburgh to give this Memorial Lecture.

Cephalometric Changes in Seven 'Post-Normal' Cases Treated by the Andresen Method

J. W. SOFTLEY, B.D.S., F.D.S.

VARIOUS TYPES of malocclusion have been described as Angle Class II, but they all have one feature in common — the antero-posterior occlusion of the buccal teeth — which is post-normal occlusion.

The successful treatment of all these cases, if we except those in which upper premolars are extracted, involves a change in this antero-posterior occlusion.

The dimension of this change is rather less than the width of an upper premolar, i.e. 5–6 mm.

The purpose of this paper is:—

1. To examine the variations in the facial skeleton and in the dentures which in theory may give rise to the post-normal relation of the buccal teeth.
2. To discuss the theoretical ways in which it may be corrected, and
3. To examine the results obtained in the seven cases treated by the Andresen method in the light of theoretical possibilities.

Graber (1), in a recent paper, classifies malocclusion into three groups from a cephalometric standpoint.

1. Skeletal dysplasias—mal-relation of the maxillary and mandibular bases with the teeth reflecting this mal-relation.
2. Dental dysplasias—a good skeletal pattern but with the mal-relation manifest only in the dental areas, and
3. Skeleto Dental dysplasias—a combination of the previous two.

If this is applied to post-normal occlusions of the buccal teeth, they may arise.

1. Skeletal dysplasias
   (a) maxillary base too far forwards.
   (b) mandibular base too far back.
2. Dental dysplasias. Bases in good relation.
   (a) upper buccal teeth inclined or bodily too far forwards.
   (b) lower teeth too far back.
      1. the alveolus in distal relation to the body of the mandible.
      2. the teeth tilted or placed distally in a normal alveolus.
3. Skeleto Dental dysplasias—a combination of factors from 1 and 2.

This classification agrees with the views expressed by Russell Logan (2) in his paper—The Nature of Distocclusion, and with those expressed by Björk (3).

1. Skeletal Dysplasias.

Renfroe (4) in 1941, Baldridge (5) in 1941 and Hedges (6) in 1946, all came to the conclusion that in Class II, Division 1 cases the mandible was in distal relation to the maxilla. And Renfroe concluded that these cases were not characterised by any lack of development of the mandible. He showed that in Class II, Division 2 cases the chin point is almost as far forwards as in Angle Class I cases.

Paper presented to the meeting on 8th December.

No discussion of the position of the mandible would be complete without mention of the rest position and the path of closure.

Thompson (7) states: "The relationship of the mandible at rest position to the maxilla is stable and it is not altered except by injury or disease; muscle trismus; the degree of consciousness of the individual and the normal but slow ageing process during the lifetime of the individual."

And again: "The basis for functional analysis is that the musculature is the dominant factor in establishing the position of the mandible.

Not only is the rest position highly constant but it can not be altered by prosthetic, operative or orthodontic procedures.

Just as the vertical position of the mandible is established by an equalisation of the musculature so is the horizontal both antero-posteriorly and laterally."

Thompson showed how the normal closure of the mandible from the rest position was almost a hinge movement with little movement of the condyles other than rotary.

As soon as the teeth come into contact they dictate the final closure of the mandible. Thompson demonstrated how the mandible can be guided into a distal relationship.

It should be noted that the rest position of the mandible is dependent on posture and all these results are worked out by using a stable posture, usually with the head erect.

Ricketts (8) in 1950 showed that one third of Class II malocclusions showed distal guidance and that movement of the condyle in an upward and backward direction on closing was much more frequent in Class II malocclusions.

In a later paper Ricketts (9) who used the laminagraphy technique to obtain a picture of the articulation without distortion showed that the rest position of the condyle in the Class II cases which exhibited a large range of condylar movement was more downwards and forwards than in the controls. The condylar position in occlusion was similar to the position of the condyle in the controls.

In other words it can be concluded that it was the rest position which was abnormal and not the position in occlusion as had been suggested by Thompson.

In treated Class II cases he showed that the rest position became more normal and the case no longer exhibited the wide range of movement.

He concluded that these findings called for some modification of the concept of the stability of the rest position. Although it is stable under stable conditions it may be altered if the conditions are altered, and one of the factors could be a change in occlusion.

2. Dental Dysplasias. Bases in good relation.

(a) upper buccal teeth tilted forwards or bodily too far forwards.

A distinction must be made here between the cases in which the whole alveolar process and the incisors are bodily forwards and those in which the alveolus is essentially correct but the buccal teeth are in a forward position.

Where the upper alveolus is in a forward position, extraction of upper premolars might be indicated and this type of case is outside the scope of this paper.

Cases in which the alveolar process is essentially correctly placed and in which the buccal teeth are tilted forward or have moved forward bodily are relatively more common in the writer's experience. The incisors are often over-erupted or inclined forwards, or in Class II, Division 2 cases inclined lingually.

(b) Lower teeth too far back.

(i) The alveolus in distal relation to the body of the mandible.

These cases are characterised by a definite shelf between the chin and the

alveolar process. The musculature is usually powerful and the lower lip dented. All the teeth, including the incisors, are more posterior than normal.

(ii) Buccal teeth placed bodily distally.

Although this is a theoretical possibility it occurs rarely except unilaterally. In such a unilateral case the whole lower dentition may be moved around the arch, the centre being deflected to the side on which the buccal teeth are distal. The upper buccal teeth are often displaced forwards symmetrically on both sides but due to the symmetrical arrangement of the lower teeth there is a post-normal occlusion on one side only.

THE THEORETICAL WAYS IN WHICH POST-NORMAL OCCLUSION MAY BE CORRECTED.

Having located the site of the fault it would be logical to bring the lower jaw forward if it was in distal relation to the maxilla, or to move the upper teeth back and not move the mandible if the upper teeth were placed in a forward position, etc.

But in many cases we are completely in the dark as to what has actually happened —the only thing definitely known being that previously there was a post-normal occlusion and after treatment the occlusion is correct.

The possible changes which may have taken place are:—

1. The upper teeth may have moved distally or tilted distally.
2. The lower teeth may have moved medially or tilted medially.
3. The lower jaw may have moved forwards.
4. The occlusal plane may have been tilted.
5. The lower jaw may have grown forwards and the upper teeth restrained from forward growth.
6. A combination of two or more of the above factors.

1. There can be little argument about the first method. The upper teeth can, in theory be moved distally or they can be tilted and either of these movements would produce an improved occlusion.

2. Medial movement of the lower buccal teeth. Such a movement would affect the incisors immediately and they could only remain regular if they were tilted forwards or were displaced forwards bodily.

All the evidence suggests that if the lower incisors are tilted forwards beyond the correct inclination for the particular individual they will be unstable — will relapse and if the buccal teeth have been moved forwards the incisors will become imbricated.

Similarly, incisors which are moved bodily beyond their supporting base are unstable.

It is highly undesirable, therefore, to move lower buccal teeth forwards unless the incisors are lingually inclined for that individual.

If the alveolus could be moved forwards on the body of the mandible presumably the situation would be quite different and the condition stable.

Björk (10) suggests that this might occur, in an article on treatment by the Andresen method, particularly if treatment is resorted to at an early stage.

3. The lower jaw may have moved forwards.

This particular factor has, I suppose, given rise to more controversy than all the others put together.

I find that people do not all mean the same thing when they talk of jaws moving forwards.

Some mean that the whole tempero-mandibular joint condyle and glenoid fossa migrates forwards, others that the condyle takes up a more forward position in the glenoid fossa.

Haupl, Grossmann and Clarkson (11) make many references to 'articular transformation' and state that "treat-

ment in the deciduous and mixed dentition is desirable because as a rule no difficulty will be found in inducing changes in the position of the mandible," and later they say that " changes in the position of the mandible during this period (i.e., subsequent to the eruption of the canines and second molars) are still relatively easily obtained."

Their conclusions are based on animal experiments by Breitner (12) who used fixed appliances on monkeys and on experiments carried out by Haupl and Psansky who used functional appliances.

These workers showed that histological changes took place at the tempero-mandibular joint when the animal wore appliances and these changes were an adaptation of the joint to the new conditions.

The existence of mesial guidance in which the lower jaw may have been held forwards in occlusion for many years longer than any orthodontic treatment, shows that such adaptive powers as the tempero-mandibular joint may possess are limited in extent.

Gresham (13) believes that the rest position of the mandible may be altered by Andresen treatment—Thompson, Bjork and others have been equally certain that it is unalterable by any treatment.

Gresham based his opinion on a change in the position of the pogonion when the mandible was at rest, in treated cases as compared with untreated cases. He claimed that condyle X-rays showed a difference in the symmetry of the temperomandibular joint in those cases where the position of the pogonion had been changed by treatment.

It has been mentioned that Ricketts would now support the view that the rest position might be altered.

4. An alteration of the occlusal plane.

A number of investigators have shown that the occlusal plane has been changed in many cases treated by inter-maxillary traction. Hedges (6) quoted two examples which had changed by 8° and 11°. Adams, at this society a few years ago, showed a model which quite clearly demonstrated that a tilt of the occlusal plane could quite easily result in a change in the buccal occlusion.

Brodie and others have shown that tilts of the occlusal plane tend to right themselves after treatment has ceased.

Epstein (14) found no tilting of the occlusal plane in cases treated by extra-oral anchorage.

5. The lower jaw may have grown forwards carrying the lower teeth with it and the upper teeth may have been restrained in their forward growth.

It has been shown by Brodie that the growth path of an upper molar is vertically downwards until it comes into occlusion with the lower teeth. Thereafter it grows downwards and forwards in a line parallel to the Y axis (a line from the centre of sella turcica to pogonion). It has also been shown that the upper molar follows a similar path in untreated Class II cases.

Hedges (6) and Epstein (14) in cephalometric examination of treated Class II cases showed that the upper molar followed a path which brought it into a more distal relation with the Y axis. In other words compared with untreated cases it moved relatively distally.

During the course of treatment the mandible has been increasing in length mainly by growth at the condyle. Many workers have shown that the molar, retaining its position with reference to the point of the chin, is carried forward by the condylar growth.

A combination of the forward position of the lower molar due to increases at the condyle together with a restraint of the forward growth of the upper molar would cause a change in the occlusion.

It remains for me to show the changes which have occurred in cases treated by the Andresen method.

It might be thought that the Andresen plate is merely another method of producing pressure on teeth and if it is considered in this light there is no reason to expect results essentially different from any other method of treatment.

Björk's conclusions are, in fact, in conformity with this opinion although he does make the statement quoted before, that early treatment is more likely to affect the apical base, but I am uncertain of the measurements he makes to estimate changes in the apical base.

The cases I have are only seven in number and the small amount of data on each does not allow of any general conclusions.

All the cases fall into the category of Angle Class II, Division 1.

The facial patterns are in the main characteristic of this type of occlusion when compared with Downs' standards, i.e., they show a high mandibular plane angle and a chin point relatively posterior.

All cases have been X-rayed before treatment, at intervals during treatment and tracings of the lateral X-rays have been made and the following points and planes have been marked:—

S. The centre of the sella turcica.

N. The Nasion.

A. Subspinale—a point at the innermost curvature of the anterior nasal spine to the crest of the maxillary alveolar process—to indicate the approximate junction of the basal bone and the alveolar bone.

B. Supra mentale—a similar point on the mandible to inicate the apical base of the mandible.

The Mandibular plane.

The Y axis—a line from the centre of sella turcica to the point obtained by the intersection of the mandibular plane and a tangent at the point of the chin at right angles to the mandibular plane.

Of the seven cases to be discussed, six showed clinical improvement. Three were clinically excellent. One showed a complete change from the post-normal occlusion but retained a relatively deep overbite, and two showed some improvement of the post-normal occlusion. One was a complete failure.

Of the six cases which showed clinical improvement all showed a reduction in the angle of the upper incisors. The lower incisors were changed to a smaller extent.

CHANGES IN THE ANGLE SNA.

It is important to realise that the patients are growing the whole time and any change in the SNA is a measure of the relation of the downward growth compared with the forward growth of Point A. If there is a greater downward than forward growth, Point A will be thrown backwards in relation to N. Point N is also growing forwards in relation to S.

It would appear to be of importance, therefore, to know the direction of growth in the individual cases and to know also the general trend of SNA in untreated cases.

Work has been published recently by Lande (15) who shows that SNA does not change materially over the period covered by these cases.

Changes in angle SNB are more complicated. Again it may be changed by the relation of the downward growth to the forward growth. By the position of the mandible and by any opening of the bite due to a relief of pressure on the molars which might cause them to erupt further. This might be due to wearing of the appliance and might not be a permanent effect.

Case 1. Male aged 11.10.

Full post-normal arrangement of the premolars. Molars post-normal to rather less extent. Premolar-molar occlusion corrected in eight months' treatment. $\frac{|E}{|E}$ were lost just prior to commencement of treatment. There was a space between

Case No.	Treatment in Months	$\overline{\lvert}1$ to SN	$\overline{\lvert}1$ to MAND	SNA	SNB	Y axis to SN
1.	8	117.5 − .4 113.5	92 +1 93	79.5 +1 80.5	77.5 0 77.5	68.5 +1 69.5
2.	19	117 −5.5 111	106 −2 104	87.5 −3 84.5	81.5 − .5 81	64 +2 62
3.	16	111.5 −6 95.5	95.5 −1.5 94	74 −2 72	68 0 68	77.5 +2 79.5
4.	7	108 −4 104	98 +1 99	77.5 0 77.5	74 +1 75	71.5 −1 70.5
5.	14	101 −2 99	94.5 +3.5 98	79 +1 80	72.5 +1 73.5	73.5 0 73.5
6.	12	107 −9 98	91.5 − .5 91	82 0 80	75 0 75	69 +1 70
7.	24	101 +1 102	96.5 −2.5 93	74 +1 75	64 +1.5 65.5	84 −1 83

Angle SNA has decreased in three cases by 2 or over. Angle SNB has remained materially unchanged. The Y axis has shown a general tendency to open. As has been explained this may be due to the bite plate action of the Andresen appliance. No information is at present available to indicate whether or not this tends to revert to the original position.

$\overline{\lvert}3$ and $\overline{\lvert}4$.

Cephalometric Findings.

Very little growth has taken place.

The upper incisors have been brought lingually 4°.

The lower incisors have been inclined labially 1°.

SNA has opened 1°.

SNB is unchanged.

Y axis has opened 1°.

The upper molar has moved slightly forwards compared with the Y axis. The first upper premolar shows a marked distal tilt.

There is no change of point B with reference to the chin point. The lower molar has moved slightly forwards within the mandible. The first lower premolar has tilted forwards into the space behind $\overline{\lvert}3$. There has been a slight growth of the lower jaw.

The total change in the posterior occlusion appears to be due to a combination of small changes.

The distal tilt of the upper premolars.

The mesial tilt of the lower premolars.

The slight forward growth of the lower jaw.

The slight forward movement of $\overline{\lvert}6$ within the mandible.

It should be realised that a change of 5 mm. divided between four factors only requires a little over 1 mm. change for each factor.

CASE 2. FEMALE. AGED 11.

Full post-normal occlusion of the posterior teeth completely corrected in thirteen months. Some overbite remained which was completely reduced by further treatment with the Andresen plate. (Total of nineteen months' treatment).

Cephalometric Findings

Considerable growth has taken place.

The upper incisors have been brought in 5.5°.

The lower incisors have moved lingually 2°.

SNA has reduced by 3°—this may be associated with the marked vertical growth.

SNB has reduced by .5° (i.e. of no significance).

The Y axis has opened 2°.

The upper molar has maintained its position with regard to the Y axis. There appears to be some apposition at the chin point as point B has moved back in relation to the chin point. The lower molar has not moved within the mandible.

The change in the molar relation appears to be mainly due to the growth of the mandible which has carried the lower molar forward with it. The upper molar has moved relatively distally to a small extent.

The bite appears to have opened by a relatively increased vertical growth of both the upper and lower molars as compared with the incisors.

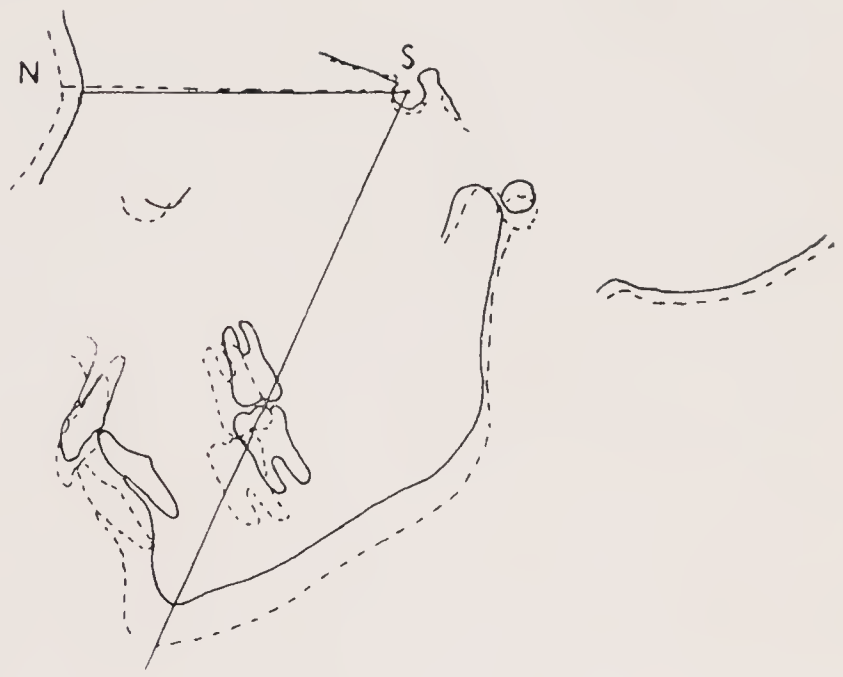

FIGURE 1
Case No. 3. Before and after tracings superimposed on the Y axis with S. registered.

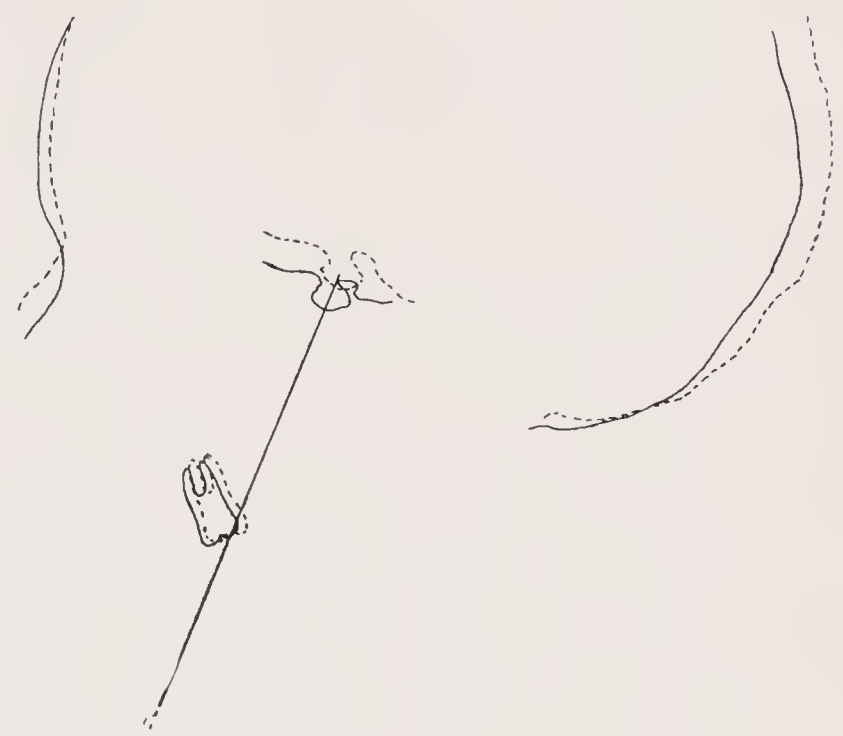

FIGURE 2
Case No. 3. Tracings superimposed on the Y axis with the occlusal surface of |6 in the same plane to show the relative distal movement of |6.

CASE 3. MALE. AGED 13.6.

Full post-normal occlusion corrected in fifteen months' treatment.

Cephalometric Findings.

Considerable growth has taken place.

The upper incisors have been brought in 6°.

The lower incisors have inclined lingually 1.5°.

SNA has decreased by 2°.

SNB shows no change.

The Y axis has opened 2°.

The upper molar has moved distally with relation to the Y axis and tilted distally.

There is no change in Point B with reference to the chin point.

There is no change in the position of |6 within the mandible.

The change in molar relation appears to be due mainly to the growth of the mandible carrying the lower molar with it and to a relatively distal positioning and tilt of the upper molar.

The bite appears to have opened by the same means as Case 2.

CASE 4. FEMALE. AGED 12.3.

Full post-normal occlusion. Showed no change, clinically, for six months. She afterwards admitted she had not worn her plate very much. Subsequently showed rapid improvement and was completely corrected in a total of thirty months.

Cephalometric Findings.

There has been considerable growth over the whole period.

The upper incisors have been brought in, the lowers proclinated.

SNA has remained virtually unchanged.

SNB has increased.

The Y axis has closed.

$\underline{|6}$ has moved distally in relation to the Y axis.

The change in the molar occlusion appears to be due to a forward growth of the mandible carrying the molar with it and to some restraint in the forward growth of the upper molar (figures in table only cover the last seven months' treatment). This case differs from the previous two in that the Y axis has closed and the angle SNB has increased.

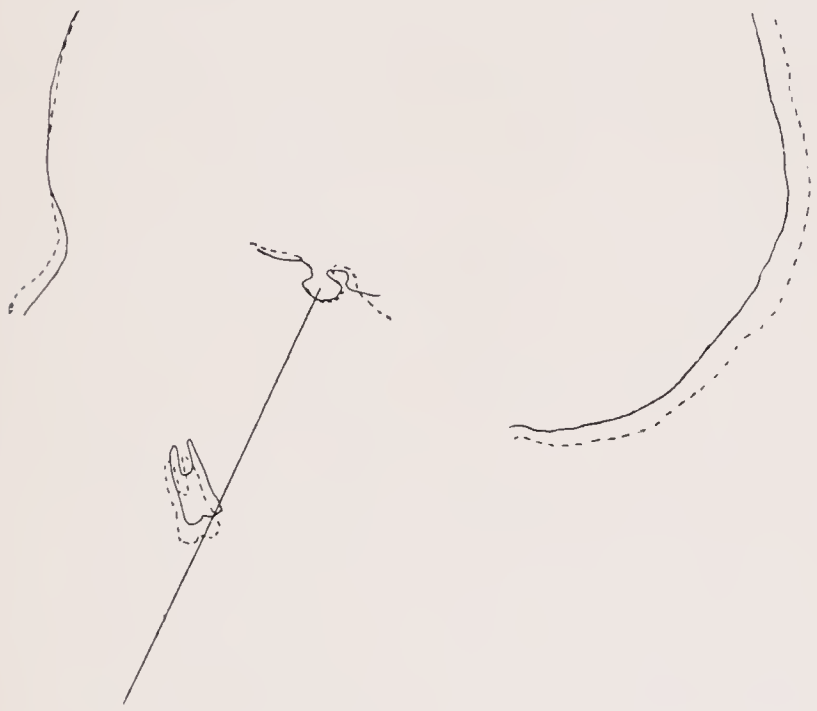

FIGURE 3

Case No. 3. Tracings superimposed on Y axis with S registered to show actual growth path of $\underline{|6}$ with reference to the Y axis.

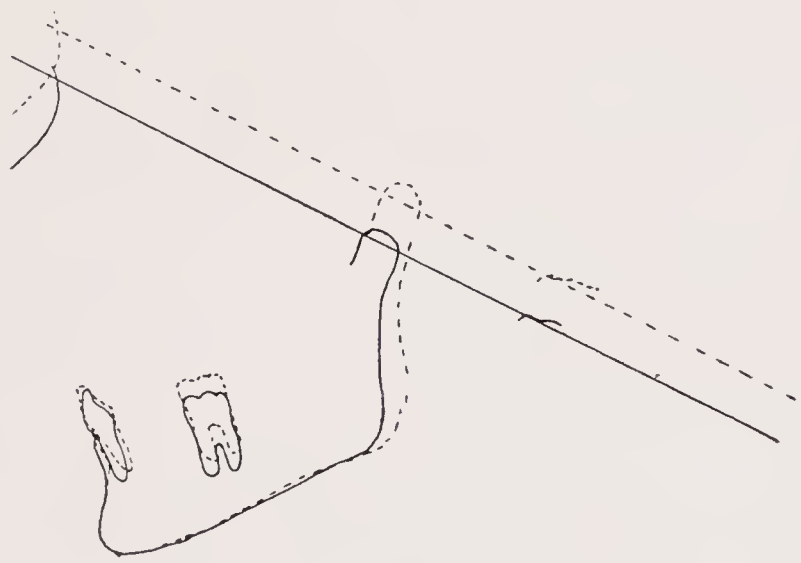

FIGURE 4

Case No. 3. Tracings of the mandible superimposed on chin point to show that $\overline{|6}$ retains its relative position. Note increase in length of the molar compared with the incisor.

CASE 5. FEMALE. AGED 11.9.

Full post-normal occlusion. Treated with an Andresen plate for fourteen months with some clinical improvement. About half cusp on the posterior teeth. Treatment completed with inter-maxillary traction, as she appeared to be unsatisfactory with the Andresen plate.

Cephalometric Findings. (Of Andresen treatment).

The upper incisors have been brought in 2°.

The lower incisors have proclinated 3.5°.

SNA and SNB both show an increase of 1°.

The Y axis is unchanged.

The upper molar has moved forwards in relation to the Y axis. ($\underline{|E}$ was lost immediately prior to treatment).

Point B has not changed in relation to the point of the chin.

The lower molar has moved forwards within the mandible. ($\overline{|E}$ was lost immediately prior to treatment).

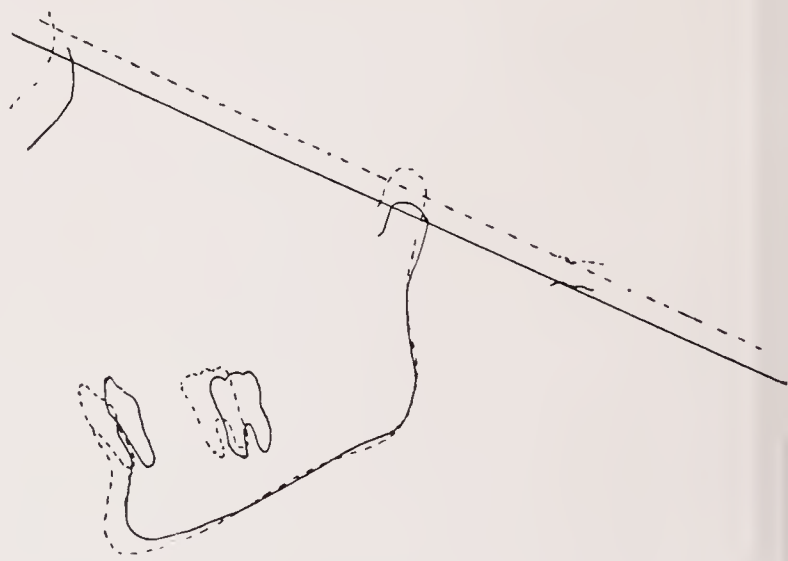

FIGURE 5

Case No. 3. Tracings of the mandible superimposed on GN to show how the lower teeth are carried forward with the growth of the mandible.

The improvement in the molar relation appears to be due mainly to the growth of the mandible carrying the lower molar with it.

FIGURE 6
Case No. 6. To show tilt of occlusal plane.

CASE. 6. FEMALE AGED 12.1.

Full post-normal occlusion. Changed half unit in twelve months' treatment. $\frac{7|7}{7|7}$ were extracted at the commencement of treatment.

Cephalometric Findings.

The patient has an extremely small skull particularly vertically. Very little growth has taken place in the twelve months.

The upper incisors have been brought in 9°.

The lowers have remained virtually the same.

SNA has been reduced by 2°.

SNB remains the same.

The Y axis has opened 1°.

There is a marked distal tilt of the upper molar in relation to the Y axis and the whole of the occlusal plane, taken from the occlusal surface of the molar to the tip of the incisor, has tilted downwards 5° in relation to the line of the palate.

Point B has not altered in relation to the chin point but $\overline{|6}$ has moved backwards within the mandible (Extraction of $\overline{|7}$).

The change in occlusion appears to be mainly due to the tilt of the occlusal plane.

CASE 7. MALE. AGED 8.

Full post-normal occlusion. An unsatisfactory patient. Treated for two years with little or no co-operation. The occlusion got worse over the period.

Cephalometric Findings.

There has been very little vertical growth over the two years.

The upper incisors have inclined labially 1°.

The lower incisors have inclined lingually 2.5°.

SNA has increased 1°.

SNB has increased 1.5°.

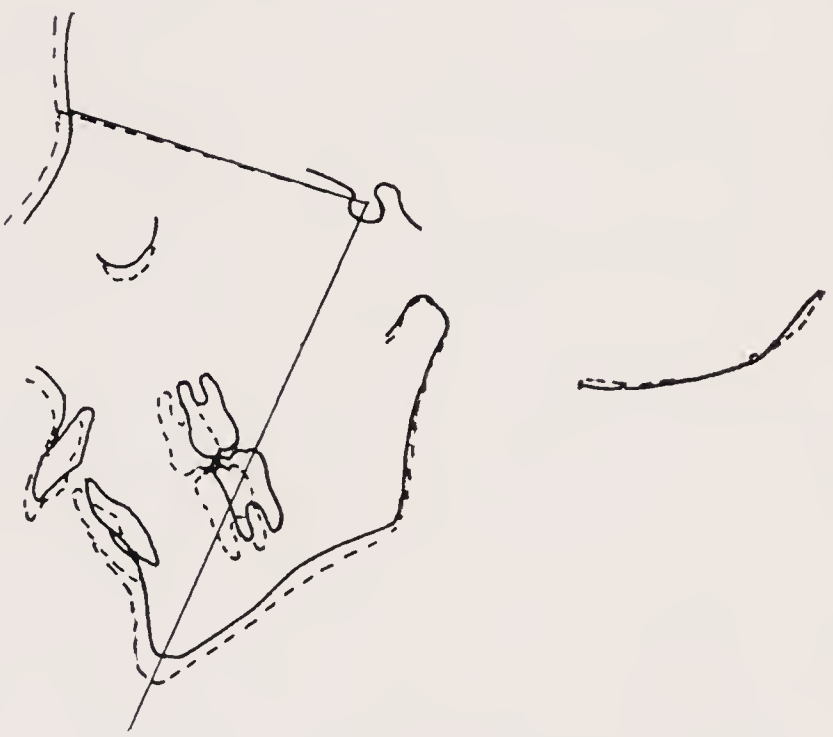

FIGURE 7
Case No. 7. Tracings superimposed on the Y axis with S registered showing no improvement in occlusion.

The Y axis has closed 1°.

Point B has not altered in relation to the chin point, the lower molar has not altered antero-posteriorly within the mandible.

The upper molar has moved forwards in relation to the Y axis.

SUMMARY

The cephalometric findings have been given for seven cases, six of which showed clinical improvement and one a failure.

1. There has been a decrease in the protrusion of the upper incisors in all cases, which were improved.
2. The lower incisors have generally remained fairly stable.

3. Angles SNA were decreased by 2° or over in three cases.
4. Angles SNB remained materially unchanged.
5. The posterior occlusion has been altered in various ways.
   (a) by the cumulative effect of small changes in the inclinations and positions of the teeth in one case.
   (b) by a tilt of the occlusal plane in one case.
   (c) by the growth of the mandible carrying the lower molar with it and a restriction of the forward growth of the upper molar to a varying degree in four cases.
6. There has been no material change in the position of Point B with regard to the chin point.
7. The lower molar has remained essentially in the same relative position within the mandible except where $\overline{E}|\overline{E}$ have been extracted or in one case where $|\overline{7}$ has been removed.
8. The Y axis has shown a general tendency to open. No information is available as to the permanence of this change.
9. The best clinical results were obtained in the cases which showed the greatest growth.

ACKNOWLEDGEMENTS

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DISCUSSION

Mr. C. F. BALLARD, in opening the discussion, said that he would like to congratulate Mr. Softley on being the first to bring before the Society some cephalometric analyses of treated cases.

He would like to argue with Mr. Softley on almost every point in the paper, not because he disagreed with him but because he had been looking at lateral radiographs of treated cases for some years and, quite frankly, he felt that he could not make the statements which Mr. Softley had made in his paper.

His observations from lateral radiographs had made him wish to do a tremendous amount of research work. He thought that, before one could make any statements at all about what had occurred as a result of treatment, one had to know what occurred as the result of normal growth. American orthodontists had rather failed in this respect, because in their cephalometric analyses of cases they had been too preoccupied to find a normal from which they could produce a template for the guidance of those who learned their orthodontics in a year or eighteen months post-graduate course. They had not analysed cases or attempted to break down the various crano-facial forms, so that one could look at a case and say that the growth direction would be such that it would either help one in treatment or make prognosis poorer. It seemed to him that that was the sort of thing that had to be done before one could get down to a detailed analysis of what took place during treatment. In Class II, Division 1 cases it was very essential to break them down into various types in order to assess prognosis for a correct planning of treatment.

(*Slide*)

The slide showed one of Brodie's cases before and after treatment. He thought that from the point of view of prognosis of Class II, Division 1 cases when the mandibular dental base was distal to the maxillary dental base the important point was whether the latter would move forward in relation to the former during growth. At the Eastman Dental Hospital, where he and his colleagues had used both fixed appliances and Andresen appliances, the results of their treatment were more or less the same as Mr. Softley's. In the majority of cases the mandibular dental base did not move forward in relation to the maxillary dental base. In one or two cases, however, it did appear that the mandibular dental base had grown forward in relation to the maxillary dental base. He thought that this was part of the normal growth trend of the individual and made the prognosis relatively better. When Mr. Softley said that one of the difficulties was a dento-alveolar dysplasia he would like him to have mentioned that these dento-alveolar dysplasias were possibly due to abnormal soft tissue behaviour.

(*Slide*)

The slide showed a case from the Eastman Dental Hospital in which the prognosis was good because the dental base relationships were within the normal. In other words, the dento-alveolar abnormality was entirely the result of soft tissue behaviour, and normal occlusion could be produced with changes entirely within the dento-alveolar structures. Nowadays there was no difficulty whatever in putting the cheek teeth exactly where one wanted them in relation to the labial segments.

Mr. J. W. SOFTLEY, in replying to Mr. Ballard, said that he and his colleagues were somewhat in the position of amateurs in cephalometric work and they had not time to obtain enough data on normal growth patterns; consequently they had taken other people's work as being representative of normal growth behaviour and they based the results of the changes on these.

In a recent article in *The Angle Orthodontist*, Lande had analysed a large number

of cephalometric radiographs in the way which Mr. Ballard desired. Lande had shown the interesting point that cases which had abnormal patterns, such as Mr. Ballard had shown, did not, as a general rule, become worse. The general pattern was, that, as Brodie had shown, point B got slightly further forward in relation to point A as the patient grew older, and the angle between the Y axis and the SN plane decreased, which, of course, was an indication of the same thing.

He had not gone into the question of soft tissue behaviour. He had not felt that he was concerned so much with that as with the posterior teeth. He had confined himself to the actual skeletal changes which had taken place under the Andresen treatment.

When he had spoken of the incisor position of each individual, he had been including the whole balance for each individual, taking into consideration the relationship of the bases and, of course, the lip position, etc. He did not think that in fact he would be in disagreement with Mr. Ballard.

It had so happened that the cases which he and his colleagues had chosen had fairly normal facial patterns with the exception of the last case.

According to Downs, the average angle ANB in a normal case with good occlusion was about 2°. In one of his cases it had been 6° and had been reduced to 4°, others of the cases had had an ANB angle which was considerably greater than 2°.

He agreed that the angle ANB had been changed in some of the cases. In others, although the occlusion had improved, the angle ANB had become slightly greater. That had occurred mainly in those cases in which Y axis had opened. In some cases the angle ANB had been reduced by a relatively distal movement of point A. He could not say whether that had been due to treatment or not, because he did not know the direction of growth in the particular individual. He felt fairly confident that in the case in which the occlusal plane had been tilted downwards the point A had been pushed backwards by treatment. In one of the other cases, in which there had been a great deal of vertical growth as compared with horizontal growth, it was by no means certain that it was the treatment that had influenced the position of Point A.

He wished to thank Mr. Ballard for his remarks and for opening the discussion.

Mr. C. P. ADAMS said that he would like to congratulate Mr. Softley on his paper, because it was the first of its kind which had been presented to the Society since the members had been using the Andresen plate and since they had acquired the cephalometric apparatus in this country for assessment of results. He thought that the paper was a triumph, because, as Mr. Softley had mentioned, there had been great difficulties, firstly in getting a number of cases of a similar kind to work on, and, secondly at the end of two years, in keeping sight of a small number of those cases to show to the Society. In presenting the paper, Mr. Softley had, as it were, put his head into the lion's mouth, and there were plenty of lions waiting to close their jaws upon him.

Mr. Adams said he had received the impression, from some cases which he had seen treated by the Andresen method and analysed with lateral X-rays, that the major changes took place in the upper jaw, and he thought that several of the observations which Mr. Softley had made confirmed that view. It was risky to make generalisations without producing enough evidence to support them, so he would not say that it was more than an impression that he had gained, but he would like Mr. Softley to comment upon it and to say whether he had received the same impression.

He thought that the criticism that Mr. Softley had not analysed the cases in complete detail was probably a just one,

but, at the same time, the investigation had been undertaken to show the changes that took place in a certain number of cases not necessarily all the same. The difficulty of getting cases which were identical was almost insuperable, and he thought that Mr. Softley's method of analysing them individually and pointing out the changes that took place in each case was very interesting. The making of generalisations would involve an amount of work which in comparison would be enormous, because of the difficulty of collecting identical cases and then analysing them statistically. He thought, however, that it was possible that from Mr. Softley's paper a few points about treatment by the Andresen method might emerge, such as the one that he had mentioned, and that, by obtaining small indications of definite trends in changes that resulted from the treatment, one might eventually be able to make more certain generalisations.

Mr. W. Russell Logan said that he also would like to congratulate Mr. Softley on his excellent paper, which he thought the members would find very valuable when it was published and they could read it carefully.

He particularly liked the lay-out of Mr. Softley's investigation, to which much thought must have been devoted. Mr. Softley had discussed the theoretical possibilities one after another and then by practical observation he had discovered how far they were actually borne out by the progress of his cases. There was no doubt that orthodontists would have to do a great deal more cephalometric analysis of their treated cases if they were to learn anything about orthodontic treatment.

What lesson were the members to take away with them from the present meeting? Perhaps Mr. Softley would be shocked if he went so far as to say that he was prepared to take a jump forward and say that the lesson which he would take away with him was the following. If treatment could be carried out during a flood tide of growth in the face, the treatment was likely to be successful, but, if the tide of growth in the face was running slowly or was not running at all, as might happen, the outlook of orthodontic therapy might be poor indeed.

Mr. K. E. Pringle, referring to the use of the Andresen appliance, said he did not suppose the trimming was of the same character in each case, but it might make a considerable difference, for example, in the case of point A, whether or not one used the appliance without trimming behind the upper incisors. Trimming might also make a difference to what happened to the lower molar, whether it was forced forward or whether it came straight up.

He had been interested in the first case described in the paper, in which Mr. Softley seemed puzzled that the bite anteriorly had not opened. He wondered whether, if Mr. Softley continued his treatment for another year and the incisors were nearer together, that might take place.

He would like to thank Mr. Softley very much for his paper.

Mr. D. F. Glass said that the trouble with regard to the Andresen appliance seemed to him to be that all orthodontists were trying to use it and they all had entirely different ideas about what they were doing with it. Were they bringing the lower jaw forward, tensing the muscles that supported it and drawing the maxillary teeth back; or were they opening the bite and allowing growth at the condyle; or were they doing a mixture of those things? In Norway orthodontists treated their cases with the Andresen and springs to move the first molars back into normal relation with the mandibular first molars, and then they activated the appliance. They did not cut facets at all, yet Mr. Pringle cut facets and he did so himself. He did not know why they did it, except that someone had told them to do it.

With regard to the springing up growth period, to which Mr. Russell Logan had

referred, that period varied, as Professor Harris had explained, according to what caused the growth. If one considered that the growth was caused by cartilaginous growth at the head of the condyle, the springing up period had nothing whatever to do with the maxillary teeth and the maxilla, which was not a cartilaginous bone. Therefore one could not co-ordinate in any way upper and lower jaw growth times.

He would like to know what Mr. Softley thought he did when he fitted an Andresen plate.

Mr. E. K. BREAKSPEAR said he was glad that the question of trimming the Andresen appliance had been raised, because he had always suspected that it was not necessary. In one of his cases the lower facets had been trimmed, but the patient had failed to keep her appointments and the upper facets had not been trimmed until about two months later, yet he had found that very good progress had been made. He would like to know what Mr. Softley thought about that, in view of Mr. Softley's finding that the upper teeth appeared to be the ones that moved the most.

Mr. H. WILSON said that in his experience it did not seem to make any difference whether the Andresen appliance was trimmed or was not trimmed.

He would like to ask Mr. Softley whether in the type of case where the lower teeth were very far behind the basal bone, he found that, as Mr. Ballard had suggested, there was a large free-way space. In other words, was there a tongue habit?

He would also like to know if, during his investigations, Mr. Softley had studied the relationship of the condyle to the eminentia. Did he find that the condyle changed its position at all? He understood that Dr. Brodie, in his recent investigations, on that point, had found that there was a difference, and he wondered whether Mr. Softley had found the same thing.

Mr. C. L. ENDICOTT congratulated Mr. Softley on the very courageous presentation which he had made. The presentation and the discussion which had followed it had almost as great a mental fog, as far as he himself was concerned, as the fog which prevailed outside.

He gathered that of the five points set out in the summary at the end of the paper Mr. Softley favoured No. 5, and he would like to know whether that was the case.

He would also like to ask Mr. Softley whether he had had any opportunity of comparing cases treated with the Andresen appliance and cases treated by traction, from the point of view of any change in the position B. He had gained the impression that in the cases shown by Mr. Softley and treated with the Andresen appliance there had been comparatively little, if any, change in the position B, whereas he believed that in certain cases treated by traction there had been an appreciable change in B.

He himself had had no experience whatever in cephalometrics and he had never traced a single case, although he had studied many of the X-rays, but for a number of years he had had a good deal of experience with the Andresen appliance, and his experience had led him to favour it very much more than traction in the type of case in question. He felt that with the Andresen appliance there was less tendency than there was with traction to drag the lower teeth forward through the bone, particularly where a lingual arch was used in the lower, although he thought the same tendency occurred even with the multiple band appliance. It seemed to him that that tendency was greater with fixed appliances than it was with the Andresen appliance, and that was why he was particularly interested in a comparison of the position B.

Over a period of about twelve years he had tried all the various ways of trimming the Andresen appliance that he could think of, and he had now reached the conclusion that the more freely it was trimmed the better it worked, or, in other

words, the worse it fitted the better it worked. He now made a practice of trimming each Andresen appliance as freely as possible.

Mr. A. W. EASTWOOD congratulated Mr. Softley on his presentation of a very difficult subject.

With regard to the list of results based on certain numerical findings, in the main they were degree differences and millimetric differences, and he would like to ask what was the margin of allowable error. Had one person done all the tracings?

In the case of the direct measurements on the head plates, what was the degree of enlargement and had any correction been made for that?

He had been very glad that the question of trimming had been brought up, because, although his experience with the Andresen appliance was very limited, he had been interested to see the amazing results which it had produced both in this country and in Holland. Dr. Petrick of Vienna had shown astounding results in all three of Angle's classifications, and his method of trimming was vertical rather than oblique; he also capped the lower incisors, because he felt that in the main the influence of the Andresen appliance was to move the lower jaw forward and hold it there. Dr. Petrick had shown him that it stayed there. The results obtained by Dr. Petrick showed that if one trimmed vertically or obliquely one was bound to get some arch expansion. What effect did that have on the distal movement of the molar which Mr. Softley had shown? He felt that, in order to correlate that and to give an accurate finding, in the use of the Andresen appliance analyses should be correlatedwith the frontal as well as the lateral headplate.

The PRESIDENT asked Mr. Softley how far he believed that the alveolar process moved forward on the maxillary base or the mandibular base. He could understand what Mr. Endicott had said about the teeth moving through the bone and the question of traction, but he could not understand how one could move the alveolar bone on the base. He understood Mr. Softley to say that B moved back in relation to GN, but one of the slides had shown that GN grew at a particular period.

He had been surprised to hear that the length of GO GN increased so much in two years. He had been reading the paper which Dr. Scott had read in Norway last year, in which it was shown that the length of the dental arch increased very little over a much longer period. He might have gained a wrong impression from the diagrams, but he could not imagine how Mr. Softley had got an increase of 6 mm. in GO GN in two years.

Mr. J. W. SOFTLEY, in replying to the discussion, thanked the speakers for the kind remarks which they had made.

He agreed with Mr. Adams that the upper jaw appeared to be more easily changed than the lower, but he had not a great deal of information on which to base that view. One seemed to be able to move teeth much more easily in the upper jaw than one could in the lower jaw.

He had tried to generalise on the cases, but, apart from the lingual inclination of the incisors and one or two other factors of a very general nature, he had had to give up that method and treat each case individually. One would need many more cases before it would be legitimate to generalise and before it would be legitimate to use statistical analysis.

He agreed in general with the remarks made by Mr. Russell Logan. He thought that successful treatment did depend on growth in the majority of cases. He would not enter into an argument about the flood tide of growth; he would merely say that successful treatment depended on growth. It would have been noticed that the first case he had shown the antero-posterior relationship had been changed completely from post-normal to normal in eight months and practically no growth at all had taken place over that time. If there

was no growth going on, the changes which occurred were usually a combination of minor changes or movements of the teeth within the jaw, and nothing else. When a great deal of growth took place, it seemed possible to modify the direction of growth of the teeth, particularly the upper teeth.

He would like to add one point to the lesson which Mr. Russell Logan had said that he would take away from the meeting, namely, that one must have not only growth going on but a good base on which to work. He did not think that it was possible to obtain a good result if the bases were completely hopeless and well out of relationship to each other.

In the cases which he had shown, none of the Andresen plates had been trimmed behind the upper incisors. All of them had been trimmed in the posterior region. All the cases were of a similar type, having a deep overbite to start with, and that was the reason for the method of trimming.

He had not consciously opened the bite to the same extent in all the cases. The general rule he had followed was that, if the patient had poor lip tone and poor muscle tone the bite was opened more than if the muscle tone was good. He was also inclined to bring the lower jaw as far forward with the bite as the patient would tolerate. He thought it was quite likely that the distance one brought the lower jaw forward was relevant, and he imagined that the further one could bring the lower jaw forward, the more likely one was to get a better result, particularly on the inclination of the upper incisors.

He did not know why orthodontists cut facets. He did not think that the facets by themselves mattered very much. He was inclined to think that it was solid block which one could always get in front of the upper first premolar that was responsible for keeping distal pressure on the upper buccal teeth. He had trimmed all the cases to be free at the back. He did not know what would happen if there was a close bite and one did not trim it.

Mr. Breakspear had indicated that trimming had not mattered in one case to which he had referred, but he had not said what the bite had been in that case. Personally he did not make his cases free at the back unless he was attempting to open the bite.

He was sorry that he was not able to give any information on the points which Mr. Wilson had raised.

With regard to the condyle relationship, the temporomandibular articulation was masked in the ordinary lateral X-ray, and it was necessary to take separate X-rays to see that. He had not done that yet, but he intended to do it in another series of cases on rather different lines.

Mr. Endicott was right in thinking that he favoured point No. 5 in his list, i.e., the growth of the lower jaw carrying the lower molar with it, or the lower molar going forward with the growth of the lower jaw and the upper molar being restricted in its forward growth, as being the most likely thing that happened in the cases in question, provided that there was active growth going on.

He was not able to say what happened to point B in cases where intermaxillary traction was used. He knew that the lower molar was moved forwards in cases in which he had used intermaxillary traction, and he had a series of cephalometric X-rays of cases treated by intermaxillary traction, but he had not in fact investigated what had happened to point B in those cases.

He had expected that someone would ask him about the errors in the cases, and Mr. Eastwood had not disappointed him! The tracings had all been done by one person. All of them had been measured by two people, and a number of them had been measured by a third person also. He regretted that no allowance had been made for enlargement in the actual measurements which had been taken. He had only taken the measurements in order to give

an idea of the general direction of growth which was going on.

The President had asked him about the forward movement of the alveolar process on the basal bone. He had found that in the lower jaw it had not in fact been moved forwards. He thought there had been one or two cases in which point B had moved distally in relation to the chin point. He regarded that as being due to the apposition at the chin point, not to point B having moved back but to point GN having moved forwards, and that was, of course, in conformity with the usual findings of people who had worked on such cases by varying methods.

Valedictory Address

HAROLD CHAPMAN, F.D.S.R.C.S. (ENG.)

VALEDICTORY ADDRESSES are less in vogue nowadays; yet it would seem that something is lacking were I to induct my successor and descend to the body of the hall with no more ado, so I crave your indulgence for a few moments. You may think I should speak of the past, but I have chosen to think of the future.

A custom has arisen of supplementing titles of papers with the meaning of a particular word. The Concise Oxford Dictionary says a valedictory address is " a farewell oration delivered by senior scholar on graduation etc." so here am I, a senior scholar, all too well aware that my experience of 30 years' exclusive practice of orthodontics is totally inadequate.

The membership of the Society is 367, of whom a small minority practises orthodontics exclusively; but the majority have many opportunities and responsibilities outside those of the specialists. In this connection I would remind you of Sir James Mackenzie, the famous heart specialist: I quote from a recent article[1]: " He was a general practitioner until the age of 54 when he became a consultant at a teaching hospital of first rank. After eleven years he returned to general practice, despite a world wide reputation as a consultant; this is a symbol of great value to a general practitioner. In practice he carried out research of the first importance, research much of which could only be done by a general practitioner.' So far from the general practitioner being ousted from his responsibilities Sir James asserts that there are special fields peculiar to him. Chief of these is his privileged ability to follow his patient clinically for years; he is the only person who can study the earliest stages of disease. General practice is no bar to research. There should be in every school of medicine one or more teachers who have been in general practice for 10 or 20 years. A reason for the comparative absence of research is that general practitioners have tended to be isolated intellectually from their fellows. Research requires discussion, stimulation, and co-operation."

Here, in this hall and in the Council Room over coffee, you throw off your isolation, discuss your problems and stimulate one another; this occurs only seven times a year so I suggest that you form yourselves into groups for study in the intervals. The stimulus provided by 120 colleagues meeting here will carry you along and your studies progress. The Society is a large study club, its increasing size makes smaller units both more desirable and practical. I commend this idea to your consideration. I gather that some of you do this already at the termination of our meetings but in another place.

The general practitioner is the first to see developing dentitions; he has the opportunity to watch the various changes in normal and abnormal cases; he can observe the results of treatment in after

Presented to the meeting on 8th December.

years and judge how great or small are the benefits; these are largely unknown if we think in decades after completion of treatment. While it is pointed out academically what are the advantages, say from the standpoint of caries and the supporting tissues, it is fair to say that little is known clinically about the effects of orthodontic treatment on the dentition as a whole in after years. T. M. Graber (1952)[2] says: "Periodontists can supply us with ample evidence that all too often we have let ideal occlusion be our sole goal, to the detriment of the teeth and investing tissues."

You have the opportunity to study these and other problems and report your findings, so that the profession may learn if the claims that are made as to the benefits of treatment are substantiated. A finely balanced judgment is essential in advising what, if any, orthodontic treatment should be undertaken in any particular case—do not overlook the fact that while there are many "pros" for treatment, there are also many "cons" and that the latter may only come into evidence in the course of time.

I confess to a feeling of awe sometimes when confronted with the whole-hearted enthusiasm with which a confrere (not always non-orthodontic) suggests treatment as an unquestioned boon to a particular patient.

In conclusion I thank most sincerely my very able lieutenants here on my right and left, and the other officers and councillors who are equally assiduous in the conduct of your business before each meeting; a number also spend many additional hours in your service of which little or nothing is heard but may be seen in the library, museum and transactions. Last, but not least, I thank you, ladies and gentlemen, for your support during a very happy and useful year of office.

Whilst I have been your President I have also been a usurper; I now correct this. Mr. Pilbeam, it is my happy duty to induct you to the Presidential Chair; you have done very much valuable work for the Society, particularly as Chairman of the Committee on Undergraduate Education and as Editor for many years, the latter a very onerous office. Finally, I wish to thank you personally for so graciously delaying your accession to the rostrum that I might occupy it.

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[1] HORDER, Dr. John (1952) "*The Opinions of Sir James Mackenzie*" London Hospital Gazette 55, 138 (it will be noticed how applicable they are to orthodontics).

[2] GRABER, T. M. "*New Horizons in Case Analysis Clinical Cephalometrics*", Amer. J. Orthodont. 38, 603 (August, 1952).

Ordinary Meeting

held on 14th January.

AN ORDINARY MEETING of the Society was held at Manson House, 26, Portland Place, London, W.1., on Monday, January 14th, 1952, at 7.30 p.m. Mr. Harold Chapman, President, occupied the Chair.

The Minutes of the Annual General Meeting, held on December 10th, 1951, were read, confirmed and signed.

The following members who were attending a meeting of the Society for the first time since their election were introduced to the President: Dr. K. T. Adamson, Mr. L. D. Carton-Kelly and Mr. C. P. Cousins.

The following candidates for membership of the Society were elected *en bloc* by show of hands.

Miss D. E. M. Warner, L.D.S., R.C.S. (Eng.), 19 Downage, Hendon, N.W.4.

Mr. C. H. Travis, L.D.S. (V.U. Manc.), Belsaye, Natton Road, Eastbourne, Sussex.

Mr. Y. H. Mirza, D.D.S., 2/3/205 Sarrafyia, Baghdad, Iraq (Corresponding Member).

The PRESIDENT said that there were a number of visitors present at the meeting and he would ask them to consider themselves members of the Society for the evening and to take part in any discussion that might take place.

The Society was honoured by the presence of Dr Kenneth Adamson, Director of the Orthodontic Department of the University of Melbourne, who was to give an address on " Orthodontics in Australia, the United States of America and Great Britain—a Comparison." He thought that the present was an historic occasion, as it was, to the best of his recollection, the first time that a Corresponding Member of the Society had attended and addressed a meeting of the Society.

He had first met Dr. Adamson in 1929, at a dinner given by Mr. Northcroft on the occasion of Dr. Adamson's visit to England. Dr. Adamson had been a member of the Society for many years and had contributed to orthodontic literature. The paper by Dr. Adamson which he remembered best, entitled "A Challenge to the Profession," had been published in the *Australian Journal of Dentistry* in 1950, and a long digest of that paper had appeared in the *A.J.O.* in 1951, a mark of distinction accorded to few. He had been particularly struck by the following sentence in that paper: " What is the use of discussing methods of combating the ever increasing number of malocclusions if the profession is creating them in daily practice? " That short sentence gave orthodontists much food for thought.

Dr. Adamson was one of that generous band of Australian dentists who had sent food parcels to this country during the war and after, and it was a pleasure to have the present opportunity of thanking him personally and, through him, his colleagues.

Australia was contemplating a National Health Service, and Dr. Adamson had been sent to this country by his Government to study orthodontics in the National Health Service here, so that the proposed orthodontic service in Australia might be started under the best auspices. This was a problem which many orthodontists in this country would like to know more about, and they looked to Dr. Adamson to tell them what he had discovered. They knew that it bristled with difficulties. He mentioned that in case Dr. Adamson did not refer to it in his address, as Dr. Adamson might feel that it was not included in the title of his address.

On his way to England Dr. Adamson had spent three months in various parts of

the United States, studying the problems of the orthodontic profession as he crossed the American continent.

He would now invite Dr. Adamson to relinquish his "corresponding" membership for this evening and to become a "speaking" member while he addressed the meeting. He did not take a narrow view of his subject and with that knowledge the members would listen to him the more attentively.

A short discussion followed Dr. Adamson's paper.

Mr. HAROLD CHAPMAN then read the Presidential Address:

"*Double Prognathism in Daily Practice.*"

A vote of thanks was accorded to Dr. Adamson and to Mr. Harold Chapman, which was carried by acclamation, and the meeting then terminated.

Ordinary Meeting

held on 11th February.

AN ORDINARY MEETING of the Society was hale at Manson House, 26, Portland Place, London, W.1., on Monday, February 11th, 1952, at 7.30 p.m. The President, Mr. Harold Chapman, occupied the Chair.

The minutes of the previous meeting, held on Monday, January 14th, 1952, were read and were confirmed and signed.

The President invited the meeting to stand in silence in memory of their beloved Sovereign King George VI.

The meeting stood in silence.

Mr. Frank Jones who was attending for the first time was introduced to the President.

The following candidates for election were admitted by show of hands *en bloc*:

Mrs. M. A. Tibbatts, L.D.S., 21, Marlborough Road, Castle Bromwich, Warwickshire.

Mr. K. H. Brown, L.D.S.R.C.S. (Eng.), 36, St. Johns Avenue, S.W.15.

Mr. R. Bergman, L.D.S.R.C.S. (Eng.), 1, Sneath Avenue, N.W.11.

Mr. A. J. M. Gall, L.D.S.R.F.P.S. (Glas.), L.R.C.P. & S. (Edin.), 146, Broad Street, Salford, 6, Lancs.

Mr. A. J. Bligh, B.D.S.(Lond.), Little Elms, DeTillens Lane, Oxted, Surrey.

Mr. J. E. Phillips, L.D.S.R.C.S.(Eng.), 4, Spencer Parade, Northampton.

The President invited the visitors who were present to consider themselves as members for the evening and to take part in the discussion.

Mr. H. E. Wilson made the following Short Communication:

"*Self Correction of Lost Premolar Space.*"

The PRESIDENT said that the Society was fortunate in having Mr. Emslie to present a paper on "The Ideal Occlusion for Periodontal Health." As far as his experience went, this was a new line of thought. Mr. Emslie had been working in connection with the Department of Preventive Dentistry, Guys Hospital, for several years, and in the meantime he had been to the States and taken a degree at the University of Illinois. Some work on the same subject had been done recently at the North Western University. A short account of which appeared in the *North Western Bulletin*. He was looking to Mr. Emslie to carry the subject some stages further.

Mr. R. D. Emslie read the following paper:

"*The Ideal Occlusion for Periodontal Health.*"

A vote of thanks was accorded to Mr. H. E. Wilson and to Mr. R. D. Emslie which was carried with acclamation and the meeting then terminated.

Ordinary Meeting

held on 10th March.

AN ORDINARY MEETING of the Society was held at Manson House, 26, Portland Place, London, W.1., on Monday, March 10th, 1952, at 7.30 p.m. The President, Mr. Harold Chapman, occupied the Chair.

The Minutes of the previous meeting, held on February 11th, 1952, were read and confirmed.

Three members who were attending for the first time since their election was confirmed were introduced to the President.

The following candidates were admitted by show of hands *en bloc*:

Mr. P. Readings, L.D.S., R.C.S.(Eng.), Quoins, Museum Hill, Haslemere, Surrey.

Mr. P. A. Swift, L.D.S., R.C.S.(Eng.), 61 Southway, Shirley, Surrey.

The PRESIDENT welcomed visitors and invited them to become members for the evening and to take part in the discussion.

He called on Mr. J. S. Beresford to make a Short Communication.

Mr. J. S. BERESFORD made the following Short Communication:

"*A Modification for the Sved Bite Plate.*"

The vote of thanks was carried with acclamation and the meeting then terminated.

Demonstration Meeting

held on 12th May.

A demonstration Meeting of the Society was held at Manson House, 26, Portland Place, London, W.1. on Monday, May 12th, 1952.

The Minutes of the previous Ordinary Meeting, held on March 10th, 1952, were read, confirmed and signed.

The following candidates for election were admitted *en bloc*.

CAPT. E. J. BOWEN, L.D.S. (U.Birm.), 25 Fusilier Avenue, St. Martin's Plain, Shorncliffe.

MR. N. M. POULTER, L.D.S. (V.U. Manc.), 3 Britford, Berrow Road, Burnham-on-Sea.

MR. A. C. CAMPBELL, B.D.S. (U.Lond.), L.D.S.R.C.S. (Eng.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 57 Harley Street, London, W.1.

MR. K. A. SMITH, T.D., L.D.S.R.C.S. (Eng.), H.D.D. R.C.S. (Edin.), 23 Fosse Road Central, Leicester.

MR. D. G. BUNKER, L.D.S.R.C.S. (Eng.), 60 Bedford Road, Sandy, Bedfordshire.

MR. A. G. HUDDART, L.D.S., B.D.S. (V.U. Manc.), 48 Lullington Road, Salford, 6.

MR. J. D. O'BRIEN, L.D.S. (U.Birm.), 27 St. Mary's Road, Market Harborough.

The following Demonstrations were then given:

MISS RACHEL SCLARE: *Misfits.*

MISS E. M. WEBSTER: *Routine Cases.*

MR. W. TREVOR JOHNSON: *A Friction Fit Attachment.*

Two Fixed Appliances for Regaining Lost Space in the Mandible.

MR. B. C. LEIGHTON: *Some Abnormalities of the Deciduous Dentition.*

MR. D. F. GLASS: *The Sliding Sleeve Attachment for the Twin Wire Arch.*

MR. H. L. EIREW: *A New Technique for Processing Rubber Latex and Its Application.*

MR. W. J. TULLEY: *A Museum Demonstration.*

MR. R. PORTMAN GRAHAM: *Canine Orthodontics.*

A vote of thanks was proposed by the President, and was carried with acclamation.

Ordinary Meeting

held on 13th October.

AN ORDINARY MEETING of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, October 13th, 1952, at 7.30 p.m. The President, Mr. Harold Chapman, occupied the Chair.

The Minutes of the Demonstration Meeting held on Monday, May 12th, 1952, were read, confirmed and signed.

The PRESIDENT said that it was his sad duty to record the loss of four members of the Society—Mr. J. S. Butchart on August 2nd, Mr. B. G. McKechnie on August 22nd, Mr. E. A. Jennings on August 31st and Mr. G. F. Cale-Matthews on October 6th. Mr. Cale-Matthews, a Past-President of the Society, had taken a very great interest in the work of the Society and in the work of other orthodontic societies.

The following new members were introduced to the President and signed the Obligation Book: Mr. E. J. Bowen, Mr. J. D. O'Brien, Mr. D. G. Bunker, Mr. A. C. Campbell and Mr. K. A. Smith.

The following candidates for membership of the Society were elected *en bloc* by show of hands:

Miss A. R. Fooks, L.D.S., R.C.S.(Eng.), Sonning Lodge, Eastwood Lane, Westcliff-on-Sea.

Miss H. Shilton, L.D.S., R.C.S.(Eng.), 353, Birmingham Road, Sutton Coldfield.

Mr. J. N. K. Clarkson, L.D.S., R.C.S.(Eng.), 6, Goldington Road, Bedford.

The PRESIDENT invited the visitors present to regard themselves as members for the evening and to take part in any discussion that might take place.

The following paper was then read:

"*Some Observations upon the Environment of the Incisors*," by Mr. R. Ernest Rix.

On the motion of the President, a vote of thanks was accorded to Mr. Rix and to all those who had taken part in the discussion.

Ordinary Meeting

held on 10th November.

AN ORDINARY MEETING of the Society was held at Manson House, 26, Portland Place, London, W.1, on Monday, 10th November, 1952, at 7.30 p.m. The President, Mr. Harold Chapman, occupied the Chair.

The Minutes of the previous Ordinary Meeting were read and confirmed.

The Secretary, Mr. Howell Richards, in making a short announcement, asked everyone always to make a point of signing the Attendance Book. At the last meeting, for example, there were only 92 signatures, whereas he had counted an attendance of at least 110. A fully signed Attendance Book would be a reflection of the enthusiasm of the Society.

Four members who were attending for the first time were introduced to the President.

The following five candidates for election were admitted *en bloc* by a show of hands:

Mr. J. L. Attenborough, B.D.S., L.D.S., Cyra, Westdale Lane, Mapperley, Nottingham.

Mr. J. G. Houston, L.D.S., R.F.P.S.(Glas.), 2, Vinicombe Street, Glasgow, W.2.

Mr. W. K. G. Monk, B.D.S.(Dunedin), National Bank of New Zealand, 14, Charles Street, London, S.W.1.

Mr. G. Sperryn-Jones, L.D.S., R.C.S. (Eng.), 125, Chertsey Road, Woking, Surrey.

Mr. C. W. Stobie, L.D.S.(U.St.And.), Hillberry, Austenwood Lane, Gerrards Cross, Bucks.

The President then welcomed any visitors who might be present and invited them to contribute to the discussion.

The President, in welcoming Professor J. C. Brash to give the Sixth Northcroft Memorial Lecture, said that Prof. Brash was no stranger to the Society, although it was 26 years since he had addressed them. On that occasion his subject had been the growth of the alveolar bone and its relation to the movements of the teeth, including eruption. There could be few who had not read what were equally valuable contributions to orthodontics, his two Dental Board lectures in 1924, "The Growth of the Jaws and Palate," and "The Genesis and Growth of Deformed Jaws and Palate;" and his series of four Dental Board lectures, "The Etiology of Irregularity and Malocclusion of the Teeth," which were delivered in 1929 and were recorded in a volume of 250 pages. This book covered the subject in the widest possible manner, and the extent of the reading that it entailed could be judged from the fact that the bibliography at the end of the book ran to 12 pages.

In the Author's acknowledgment of assistance in preparing the lectures, the first name was that of George Northcroft, who was referred to in the text a number of times and some of whose models were used to illustrate it. It was, therefore, most appropriate that one who knew their late Founder so well should deliver this Sixth Northcroft Memorial Lecture.

Professor J. C. Brash then delivered the Sixth Northcroft Memorial Lecture: "*Comparative Anatomy of Tooth Movement During Growth of the Jaws.*"

Annual General Meeting

held on 8th December.

THE ANNUAL GENERAL MEETING of the Society for the year 1952 was held at Manson House, 26, Portland Place, London, W.1, on Monday, December 8th, at 7 p.m. Mr. Harold Chapman, the retiring President, occupied the Chair.

MINUTES

The Minutes of the meeting held on Monday, November 10th, were read, confirmed and signed.

BRITISH SOCIETY OF PERIODONTOLOGY

The HON. SECRETARY said that a communication had been received from the Hon. Secretary of the British Society of Periodontology, Mr. Hamish Thomson, extending a cordial invitation to the members of the British Society for the Study of Orthodontics to attend any of the meetings of his Society. The full programme of meetings could be seen by the members after the present meeting.

ELECTION OF OFFICERS AND COUNCILLORS

No other nominations having been received, the following Officers and Councillors for 1953 nominated by the Council were declared by the President duly elected:—

President: Mr. J. F. PILBEAM.
Immediate Past President: Mr. HAROLD CHAPMAN.
Vice-Presidents: Dr. L. LINDSAY, Mr. TREVOR JOHNSON and Mr. K. E. PRINGLE.
Secretary: Mr. HOWELL RICHARDS.
Treasurer: Mr. J. S. BERESFORD.
Librarian: Mr. A. GORDON TAYLOR.
Editor: Mr. C. F. BALLARD.
Curator: Mr. W. J. TULLEY.
Councillors: Mr. J. H. HOVELL, Mr.

W. Russell Logan and
Mr. S. E. Wallis.

Election of Two Auditors

On the motion of Mr. A. Gordon Taylor, seconded by Mr. J. F. Pilbeam, the retiring Auditors, Mr. S. B. Newton and Mr. T. L. Winn, were re-elected for the year 1953.

Report of Officers

Mr. J. S. Beresford (Hon. Treasurer), in his report for the year ended September 30th, 1952, said that the most striking fact which had impressed itself upon him during the year had been the record in the accounts and financial correspondence of the time and energy devoted by Mr. Harold Chapman for so many years to the good of the Society. He regarded it as an honour to succeed in office one who had the affairs of the Society so much at heart.

The excess of income over expenditure during the year under review was less by £139 8s. 4d. than in the preceding year, and the income from members' subscriptions and the sale of Transactions was less by £62.

On the expenditure side the rise was due to increased reporting costs, which might be even higher next year, to the well deserved honorariums paid to the secretaries of the previous Honorary Treasurer and to an increased sum reserved to meet the cost of printing the Transactions.

The Northcroft Memorial Lecturer's honorarium had not been paid to Professor Friel but was held in reserve. Professor Friel had generously offered it to the Society if necessary to meet the cost of printing the blocks when his lecture was published.

He moved that the report be received.

Mr. B. C. Leighton seconded the motion, which was carried.

Mr. H. Wilson asked whether the reduction in subscriptions meant that the membership had also decreased.

The Hon. Treasurer said that was not the case, as the membership was slowly increasing. In the accounts for the year ended September 30th, 1951, there had been included a sum of £28 odd for subscriptions which should have been paid the year before that, whereas in the accounts for the year ended September 30th, 1952, the corresponding sum was only £6 6s. 0d. The timing of the resignations and the entry of new members had also had an effect on the figures.

The President said he had always thought, when he had been Hon. Treasurer, that it was a pity that the accountants did not arrange things so that such points could be clearly understood.

On the motion of the Hon. Treasurer, seconded by Mr. H. Wilson, the report was adopted.

Mr. Howell Richards (Hon. Secretary) reported that during the year December, 1951, to November, 1952, seven meetings of the Society had been held. The average attendance had been 93, which included 12 visitors per meeting.

During the year four members had died and five members had resigned.

Twenty-six new members had been elected, and the membership on January 1st, 1953, would total 367, being composed as follows:— London Members, 131; Provincial members, 192; Honorary members, 6; Corresponding members, 38. On January 1st, 1952, the total number of members had been 355, being composed as follows:—London members, 132; Provincial members, 181; Honorary members, 7; Corresponding members, 35.

He would like to repeat the appeal made in November that members should sign the attendance book, as a count on some occasions had revealed as many as twenty in excess of the number of signatures in the attendance book. In this connection he would point out that it was the responsibility of members introducing visitors to enter the names of the visitors in the space provided for them.

He moved that the report be received.

The motion was seconded by Mr. H.

WILSON and was carried.

There was no discussion on the report, and on the motion of The HON. SECRETARY, seconded by Mr. S. G. McCALLIN, the report was adopted.

Mr. A. GORDON TAYLOR (Hon. Librarian) began his report by reading the following quotations from letters which he had received from members during the past year:—

"Would you kindly send me some literature relating to orthodontic treatment of dogs."

"I would be very grateful for any paper or article which explains the aetiology of anterior open-bite."

"I shall be obliged if you will send me any recent publications and references dealing with the extraction of permanent molars in relation to orthodontic treatment."

"Can you help me with references in the literature to the use of screws, instead of hickory wood pegs, in the individual movement of teeth?"

He hoped that he had managed to satisfy these requests, although they made him conscious of his own ignorance. They also gave an indication of the increasing use of the Library and, for the statistically minded, that was confirmed by the fact that it had recently been recorded that nearly thirty items were out on loan at one time.

Recent additions to the Library included Haupl, Grossman and Clarkson's *Textbook of Functional Jaw Orthopaedics* and Fischer's *Orthodontics: Diagnosis, Prognosis, Treatment.*

Gifts of books and journals had been received from Mr. Beresford and Mr. Chapman, and the present was the appropriate time for the members to record their thanks.

He moved the reception of the report.

Mr. D. LOGIE seconded the motion, which was carried.

There was no discussion on the report, and, on the motion of The HON. LIBRARIAN, seconded by Mr. R. E. RIX, the report was adopted.

Mr. C. F. BALLARD (Hon. Editor) said again he had to apologise for the delay in the publication of the Transactions. He knew that as Honorary Editor he was responsible to the Society for their publication, but he hoped the members would believe him when he said that the delay to date had been quite outside his control and, in fact, outside the control of the Society. However, there had been several changes in the staff of the publishers of the *Dental Record*, and he had hoped that the members would have received the 1950 Transactions before the present meeting. He had been assured that they would be issued before Christmas.

It was almost certain that the 1951 Transactions would be out early in 1953, and, as far as the publishers were concerned, the 1952 Transactions also could be produced early next year, but several lecturers this year had not yet produced their manuscripts and that might delay the publication of the Transactions for 1952.

He would like to emphasise that it was essential that the instructions to lecturers should be adhered to, i.e., that all papers should be in the hands of the Secretary or the Editor seven days after they had been given. It was also a great help if the instructions with regard to illustrations were observed. In that respect it must be remembered that the illustrations were the most expensive part of the printing of any paper, and these must be kept down to a reasonable number. The Council of the Society would have to discuss this matter in detail, and some guidance on the number would have to be issued in future. As the members knew, the printing of the Society's papers in the *Dental Record* saved the Society some of the cost of the type-setting and block-making.

He remembered promising in his last report that the 1951 Transactions would be published soon after the end of the year. He hoped that the promise he had made on

the present occasion would not be similarly broken.

He moved the reception of the report.

Mr. C. P. ADAMS seconded the motion, which was carried.

Mr. J. F. PILBEAM said that when he was Editor he had calculated that the cost of printing each paper in the Transactions was over £50, so that with seven meetings a year the total cost per year was over £350, which was a considerable sum. Moreover, at that time the cost of printing had been very much cheaper than it was to-day.

The PRESIDENT said that this was far the largest item in the Society's expenditure.

On the motion of the HON. EDITOR, seconded by Mr. K. E. PRINGLE, the report was adopted.

In the absence of the Hon. Curator (Mr. W. J. Tulley), his report was read by the Hon. Secretary. It stated that during the past year the Museum had received models of interest from Mr. R. E. Rix and Mr. K. E. Pringle. This material was duplicated from models in the Dental Department for Children at Guy's Hospital. Mr. Chapman had promised some more material from his fine collection.

At the Demonstration Meeting in May the members had had an opportunity of seeing some of the material representing the Society's four main interests, namely, serial models of developing occlusions; models, photographs and cephalometric tracings of treated cases; pathological conditions of the jaws and teeth which affected the occlusion; and appliances of historical interest.

The Hon. Curator appealed especially to members who were attached to the teaching hospitals to send the Society duplicates of interesting material in their possession.

The Museum was housed at No. 28 Portland Place, in the members' rooms, adjoining the Museum of the Institute of Public Health and Hygiene.

On the motion of the HON. SECRETARY, seconded by Mr. J. S. ROSE, the report was received.

There was no discussion on the report, and, on the motion of the HON. SECRETARY, seconded by Mr. R. E. RIX, the report was adopted.

NEW MEMBER

Mr. W. G. MONK was introduced to the President and signed the Obligation Book.

The following paper was then read: "*Cephalometric Changes in Eight 'Post-normal' Cases Treated by the Andresen Method*," by Mr. J. W. Softley.

On the motion of the President, a vote of thanks was accorded, with applause, to Mr. Softley for his paper.

Vote of Thanks to the Retiring President.

Mr. E. K. BREAKSPEAR, in proposing a vote of thanks to the retiring President, said he was sure that every member of the Society must feel indebted to Mr. Chapman for the way in which he had conducted the affairs and the meetings of the Society during the past year. Moreover, the younger members in particular, for whom he was now speaking, had reason to feel grateful to Mr. Chapman for his interest and encouragement.

In a paper read before the Society some four years ago, Mr. Chapman had expressed the hope that some of the younger members would come forward with contributions and had pointed out that, while few of the members had the exceptional opportunities for research which had made possible some of the outstanding contributions to orthodontic knowledge during recent years, nearly all had some material of their own which the Society might consider, whether in the form of reports on individual cases or some simple clinical research, which would help to elucidate some of the many orthodontic points that seemed to require clarification. The fact that a number of the younger members had taken Mr. Chapman at his word was a tribute to the sincerity with which it was felt that Mr. Chapman's

suggestion had been made.

He himself had greatly appreciated the friendliness of Mr. Chapman's approach to new members. He had a remarkable gift for putting them at their ease and for remembering faces. They felt that they had a friend in him, which was a great thing for them to be able to say of one whose practical experience in orthodontics was unrivalled and whose contributions to the Transactions of the Society were probably unique in their extent and value, and who had had the very rare honour of being elected President of the Society on two occasions.

The vote of thanks was accorded with applause.

Mr. HAROLD CHAPMAN thanked Mr. Breakspear for his kind words and the members for the way in which they had received them. He was grateful to them for the vote of thanks, which was a mark of appreciation that he greatly valued. It had always been his endeavour to encourage orthodontists to do research work.

The RETIRING PRESIDENT then read a Valedictory Address.

The Retiring President then installed Mr. J. F. Pilbeam in the Presidential Chair and invested him with the President's Badge of Office.

The PRESIDENT thanked Mr. Chapman for the very kind things he had said about him, and he thanked the members of the Society for the honour they had conferred upon him in electing him to be their President for the coming year.

In one way he felt unfortunate in succeeding such an able President of the Society as Mr. Chapman, because he could not match Mr. Chapman's orthodontic erudition or the grace and ease with which he conducted the meetings, but in another sense he felt himself to be fortunate, because Mr. Chapman, as the Immediate Past-President, would always be available to him and give him help, guidance and good fellowship.

When he came to the meetings of the Society he always sensed an atmosphere of infectious enthusiasm on the part of the members for their specialty, and he thought that a President's task was made easier when he felt that he had such eager enthusiasm behind him as representing the Society. He therefore thought that his task would, with the support of the members, be an easy one for him.

In conclusion, he would like to thank the members once again very sincerely for the confidence which they had shown in him and the honour they had conferred upon him in electing him to be their President for the coming year. He would always look back on the present occasion as a great day in his life.

The meeting then terminated.

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

Balance Sheet and

Income and Expenditure Account

FOR THE YEAR ENDED 30th SEPTEMBER, 1952

FREDK. B. SMART & COMPANY, CHARTERED ACCOUNTANTS
22, Queen Street, London, E.C.4.

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

INCOME AND EXPENDITURE ACCOUNT for the year ended 30th September, 1952.

1951												1951								
£	s.	d.			£	s.	d.	£	s.	d.		£	s.	d.			£	s.	d.	
10	10	0	To Museum Rent	.. .. ..				10	10	0	By Members' Subscriptions:									
80	13	6	,, Printing and Stationery	..	81	7	0				1952 Subscriptions				1,053	0	6			
444	1	4	,, Reserve for Cost of Transactions		500	0	0				1951 Subscriptions paid in 1952	.. .. ..			6	6	0			
								581	7	0								1,059	6	6
24	17	10	,, Postage	.. ..				23	0	1	85	0	0	,, Sale of Transactions	.. ..			40	19	10
2	0	0	,, Lantern and Film Expenses	..	1	10	0				12	10	0	,, Accrued Interest on Savings Certificates	.. .. ..			12	10	0
45	0	0	,, Hire of Hall	.. .. ..	45	0	0				17	5	4	,, Interest on 2½% Consolidated Stock	.. ..			17	5	4
31	10	0	,, Reporting	.. .. ..	39	5	8				7	10	0	,, Interest on Post Office Savings Bank	.. ..			10	3	6
51	6	0	,, Refreshments	.. .. ..	58	10	0													
								144	5	8										
5	8	11	,, Travelling Expenses	.. ..																
8	8	0	,, Audit and Accountancy	..				8	8	0										
3	8	6	,, Insurance	.. .. ..				3	8	6										
24	10	0	,, Library and Journals	.. ..				10	14	10										
26	5	0	,, Northcroft Memorial Lecture					26	5	0										
			,, Honorariums:—																	
			Miss E. L. Bradley	..				21	0	0										
			Mrs. H. Watt	.. ..				5	5	0										
6	10	6	,, Sundries and Hire of Equipment for Meetings	.. ..				9	14	2										
30	11	6	,, Depreciation on Furniture and Office Equipment	.. ..				30	11	6										
405	7	9	,, Excess of Income over Expenditure for the year	..				265	15	5										
£1,200	8	10						£1,140	5	2	£1,200	8	10					£1,140	5	2

BALANCE SHEET as at 30th September, 1952.

1951 £ s. d.		£ s. d.	£ s. d.
	Accumulated Fund:—		
	Balance at 1st October, 1951	1,413 11 5	
1,413 11 5	*Add* Excess of Income over Expenditure for the year	265 15 5	
			1,679 6 10
	Creditors:—		
1,438 11 4	Transactions—1950, 1951, 1952 (Estimated by Hon. Treasurer)	1,500 0 0	
—	Northcroft Memorial Lecture	26 5 0	
22 10 0	Hire of Hall	22 10 0	
7 17 6	Museum Rent	7 17 6	
12 8 0	Refreshments	11 0 0	
12 12 0	Subscriptions in Advance	1 18 6	
	Subscriptions due for Refund	2 2 0	
5 4 0	Printing and Stationery	—	
6 9 5	Postage	—	
—	Audit and Accountancy	8 8 0	
—	Reporting	23 10 8	
			1,603 11 8
£2,919 3 8			£3,282 18 6

S. B. NEWTON, T. L. WINN } *Hon. Auditors.*

J. S. BERESFORD, *Hon. Treasurer.*

1951 £ s. d.		£ s. d.	£ s. d.
	Furniture and Office Equipment:		
	Balance at 1st October, 1951	458 12 6	
458 12 6	*Less*: Depreciation at 5% per annum on Cost ..	30 11 6	
			428 1 0
	Debtors:		
6 16 6	1952 Subscriptions received since 30th September, 1952		15 4 8
	Investments:		
375 0 0	500 National Saving Certificates Seventh Issue at Cost	375 0 0	
50 0 0	*Add*: Accrued Interest to date	62 10 0	
		437 10 0	
575 14 0	£691 5s. 10d. 2½% Consolidated Stock at Cost ..	575 14 0	
	(*Approximate Market Value* £842)		1,013 4 0
	Cash at Bank:		
1,040 5 2	Westminster Bank Limited	1,007 7 4	
407 10 0	Post Office Savings Bank	817 13 6	
			1,825 0 10
	Cash in Hand		
4 12 6	Honorary Treasurer ..	12 6	
13 0	Honorary Secretary ..	15 6	
			1 8 0
£2,919 3 8			£3,282 18 6

Certified in accordance with the Books and Vouchers of the Society.
We have verified the Investments and Cash at Bank.

FREDK. B. SMART & Co.,
Chartered Accountants.
22, Queen Street
London, E.C.4.

12th November, 1952.

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